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THE FOUNDRY

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Trade Outlook.

Delayed deliveries of both iron and fuel continue to inconvenience foundries in many sections of the country. The decline in iron prices which was expected by a large number of founders has failed to materialize, in fact the furnaces have been somewhat indifferent about crowding their books with further orders, since all the iron they can produce for some time to come is contracted for. The higher cost of ores, fuel and labor, as well as advanced freight rates, all tend to prevent any material lowering of values. The action of the Southern railroads in refusing to let their cars go north of the Ohio river has hindered the free movement of Southern iron. Connellsville coke is scarce and the output of the ovens in the Virginia and Pocahontas districts is the only source of supply which prevents an actual famine. Threatened labor troubles at these points may result in further restricting production.

In the field of labor, as far as this affects the foundry trade, no serious disturbances are looked for. The consolidation of the core makers' and molders' unions is likely to give greater stability to wage agreements and prove of advantage to all parties. The general situation in the trade is summed up as follows in a recent market review of Rogers, Brown & Co.:

"A careful investigation has been made in relation to the consumption of pig iron in the various sections of the United States, and the general report is that the tonnage is fully up to last year and in some instances greater. For a time the foundries whose contracts were principally with the machine tool works stated that demand had fallen off, but recently greater activity is reported and prospects are encouraging. As long as pig iron is being used at the present rate no apprehensions need be felt regarding the business of the year, for it is only a question of time until further purchases must be made.

"It would probably be a good thing for the market if salesmen were withdrawn and the practice of quoting by circular letter various lots of spot iron were discontinued. During a period of hesitancy such as now exists, the limited amount of iron offered is unduly magnified.

"Those who contemplate enterprises calling for the use of iron and steel may count on materially higher manufacturing costs throughout the present year and until such time as the structure of wages, transportation, and raw materials is broken dow by some great financial or other disturbance.

"A more general recognition of these facts has led to a noticeable change in the temper of buyers of pig iron. While the rate of buying is even now far below the normal, it has, nevertheless, doubled as compared with the average of the past three months. Contracts are now being freely placed for delivery the last half of the year, and prices for such delivery are coming up very close to those for delivery for the first half."

The Nomadic Element in Trades Unions.

The foundrymen of the United States are thoroughly acquainted with the floating element among molders, which is with us whether times are good or bad. There is no use of

denying that it broadens the experience of a workman to become familiar with methods in a number of establishments, the danger laying in his becoming addicted to roving habits, which cause him to change places too often. On general principles it is the steady, work-every-day mechanic who is most profitable to his employer, but very often the latter is to blame for not encouraging these to remain in his service. It is no uncommon occurrence to find the tramp element in an establishment being paid a higher rate of wages than the help which is obtained in the neighborhood. This can have but one effect, that of inducing the latter to seek other fields in an effort to obtain higher pay. Again we find in some foundries apprentices who have honestly and faithfully worked four or five years at the molders' trade, and yet are denied journeymen's wages, although they are much more capable than half of the traveling members of the trade applying for employment. It is discouraging to a young man to find that he is being taken advantage of and if he "hits the road" who will blame him? Intelligent, domestic, well trained help will always bring the greatest returns to an employer, and their claims to fair pay should not be ignored because they are home-made.

Perhaps nowhere else than in America do molders travel so extensively. Thousands of miles are covered by them in a few days on freight trains and an occasional "blind" baggage car. Yet our country is not the only one in which members of the craft make excursions to new fields, as is shown by a paper on this subject contributed to an English labor journal by S. Masterson, assistant secretary of the Friendly Society of Iron Founders, from which we take the following:

"That the traveling benefit was prominent in the minds of the founders of our society is shown by the fact that our first emblem, a crude work of art, shows a molder on the road with his pack on his back; he is saying to the foreman, 'Brother craft, can you give me a job?' and the answer is, 'If we cannot, we will assist you.' For 40 years after the establishment of the society there was no other unemployed benefit paid, only to those who went on travel. During these 40 years many changes took place in the amounts paid, and a system of mileage was introduced; at first, one half-penny per mile was allowed, this was afterwards increased to one penny per mile. This payment, by results (so dear to some modern employers), was not found satisfactory to the society, as it was found that many preferred to travel, rather than settle down to regular employment, and the cost to the society was enormous. This system of compulsory traveling led to much malingering on the sick fund. We have no statistics that enable us to give the number during these 40 years, but the total amounts paid yearly for this benefit show that the number must have been large in proportion to the total membership. At the present time something like 1,200 traveling cards annually pass through my hands for verification, etc. With this experience I think it will be admitted we ought to be in a position to judge whether it has been beneficial to us, or otherwise.

"One of its greatest benefits to the society was that it fostered and encouraged a spirit of independence among the members, that would not have existed without it, and its influence helped to make the molder what he has been, and I venture to think is still, one of the most stubborn fighters in the ranks of unionism. Another benefit was that men on travel often penetrated into remote districts, where if it had not been for their presence trade unionism would not have been heard of. Some of our oldest branches were started through the influence of men who had come on travel from other towns and brought their trade union principles with them. In the early days of the movement, when there was no cheap press and methods of transit were difficult, the man on travel would be able to impart information to his fellow workmen on wages and conditions of work existing in other parts of the country, information that must have been of great advantage to those who otherwise could not have obtained it.

"It also afforded a young man an opportunity of improving himself as a workman, as it gave him an opportunity of becoming acquainted with different methods of working, and by those means enabled him to obtain better wages than he would have received had he remained in the town where he served his apprenticeship. The influence of the traveling system was no doubt an important factor in preventing a reduction of wages during a slack time, as the men who left their home to go on the road, gave those who remained in employment a better chance of defending their rights, as by this means the surplus labor was more evenly distributed.

"If we come to consider its disadvantages we shall find that one of the worst of them

was that it had, in many cases, a demoralizing effect on the younger men. Uncertainty of employment always tends to demoralize those who suffer through it, but in the case of the traveler it is intensified. Many a young man has fallen a victim to idle and dissolute habits first brought about by going on the road, and many a young fellow who under other conditions would have remained a useful member of his society has become a burden on his fellow workmen for the remainder of his life.

"On the whole, I think it may safely be said that the traveling system so far as the molders are concerned has been beneficial, more especially in the past; whether it renders the same service at the present is, I think, doubtful. There are better opportunities for men to get to know what conditions exist in other parts of the country, means of communication are cheaper and easier, members are also allowed rail fare if they have a job to go to in the distance, with an easy system of repayment. Our monthly report also furnishes each month the condition of trade in each branch, a privilege that was not possessed by our members in the early part of our history.

"The cards issued from this office at the present may be divided into three classes: first, the young man just out of his time who finds it difficult to obtain the minimum wage in the town where he served his apprenticeship and is anxious to better his condition; second, those who have become marked men in their own districts and cannot secure employment where they are known, and last, but by no means least, the habitual tramp of whom, perhaps, we have more than any other trade society.

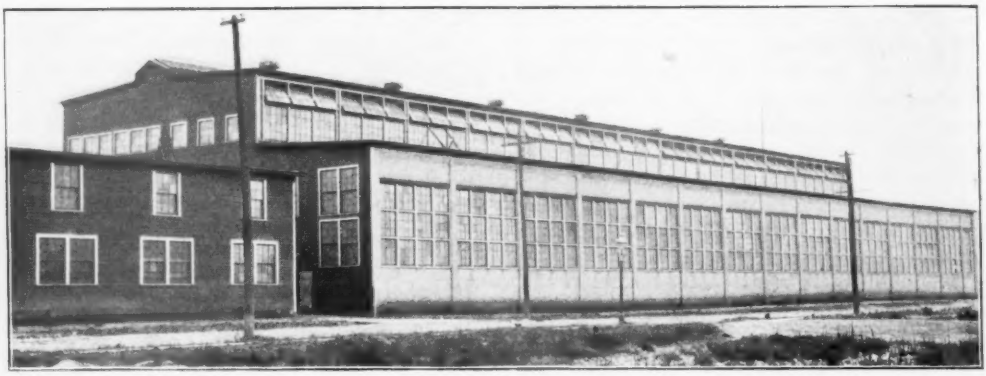
"Some of those men do not reach this stage so much from natural depravity as through that nomadic instinct which is characteristic of so many of the inhabitants of Great Britain, and once they have caught the traveling fever it is almost impossible for them to give it up; it is surprising the amount of privation that must be endured by those men in their wanderings up and down the country; many of them have been on the road for years, and often with what is known as a blank card, which only entitles them to a bed once in three months in each branch with two for Sunday, and as the sum allowed for bed was, up to recently, only 4d., now advanced to 6d., it will be seen that the amount paid was not sufficient to induce men to travel. The fact that we have always a number of those men traveling can only be accounted for by the help they receive from their fellow workmen in the shape of assistance, in many cases freely given without taking into consideration whether it is deserved or not. This generosity has always been characteristic of the British workman in all trades, and the molders have not been one whit behind other workers in assisting those who are less fortunate than themselves."

The Use of Foreign Irons by American Foundries.

At a recent meeting of the Philadelphia Foundrymen's Association several members related their experience with foreign irons, which have been sold quite extensively along the Atlantic seaboard. Mr. C. D. Matthews of the Camden Iron Works, Camden, N. J., stated that for several months they had used foreign irons exclusively. It was found that Middlesboro iron was very soft and liable to cause trouble in heavy castings on account of shrinkage, though when mixed with other brands it was perfectly satisfactory. This iron is also somewhat high in phosphorus and should therefore be used along with a portion of low phosphorus iron, and many of the German brands are satisfactory for this purpose. Mr. William H. Ridgway of the Craig Ridgway & Sons Co., Coatesville, Pa., said that they had experienced but little trouble in using foreign irons, and when unable to obtain domestic softeners had employed Scotch irons to take their place. Mr. George C. Davis stated that German irons had been very favorably received because they represented what a good gray iron should be more nearly than irons from other countries, in which a good deal of variation had been found, especially in phosphorus and manganese. The latter elements have on many occasions been rather high. As many of the irons made in Eastern Pennsylvania and New Jersey run low in manganese and phosphorus, intelligent mixing of different brands had given the founder satisfactory iron with little trouble.

The Bromley Foundry Co., of Albion, N. Y., has been organized and will carry on a general jobbing foundry.

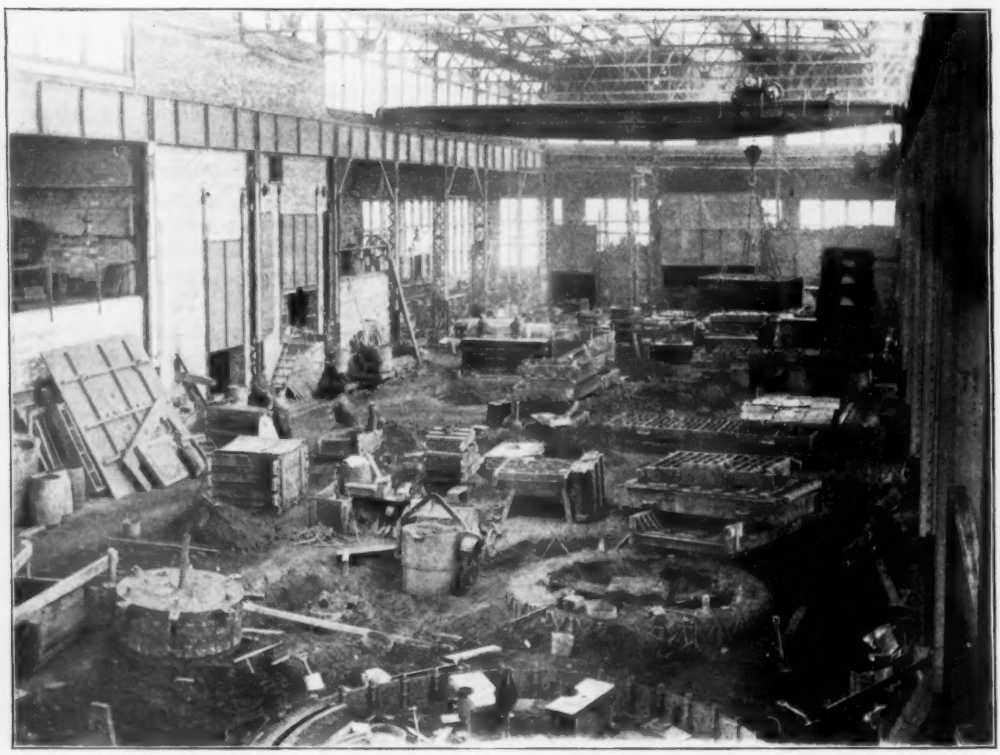
The Snead Architectural Iron Works, of Louisville, Ky., have purchased a tract of land upon which they propose to erect a modern plant for manufacturing structural and ornamental iron work. The plans provide for pattern shop, foundry and fitting shop.



FOUNDRY OF THE VILTER MFG. CO.

The Foundry of the Vilter Mfg. Co., Milwaukee, Wisconsin.

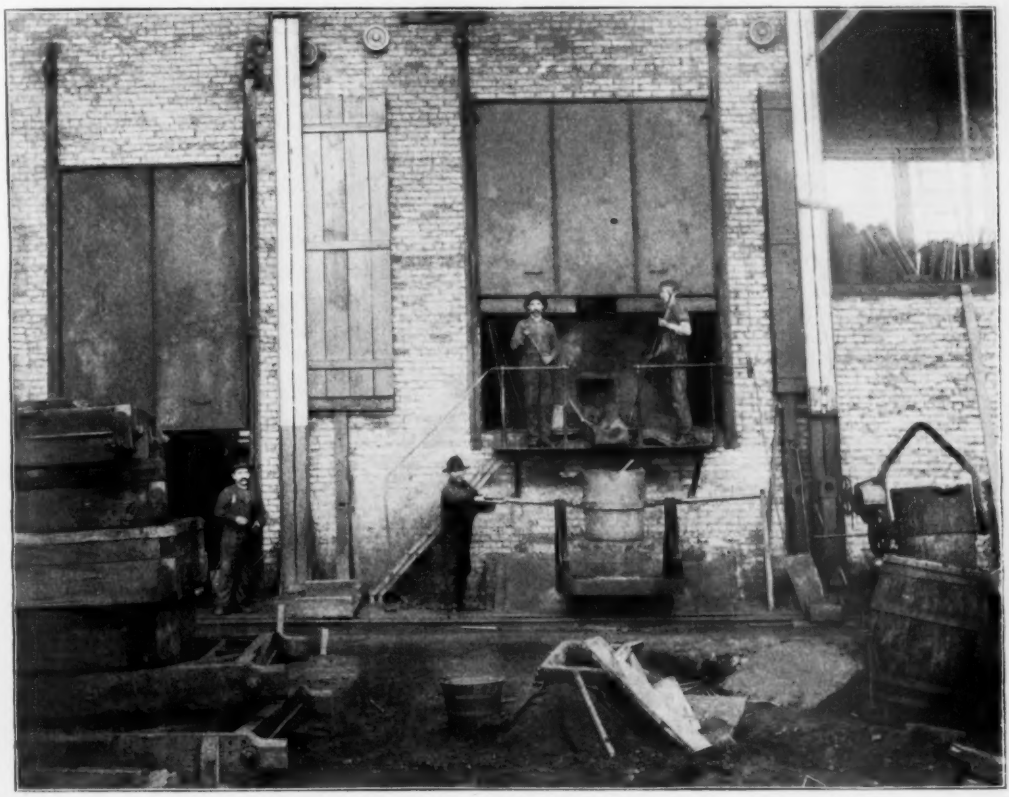
While Milwaukee is known the world over, through its extensive brewing interests, the fact that this city leads all others in the building of Corliss engines, and that its foundries form one of the largest consuming districts of foundry iron in the United States, are matters of record which have not been given as great publicity as they deserve. Again the Milwaukee foundries differ from those of other great centers in that a greater percentage of them are makers of heavy machinery and jobbing castings and therefore the class of molders employed represent a better body of mechanics than is probably to be found in any other city in the country. Of course the place is not without its specialty shops, but nevertheless the well trained molder is the



GENERAL VIEW OF MAIN MOLDING FLOOR IN THE VILTER FOUNDRY.

dominating factor, and is demanded by the high grade of castings turned out.

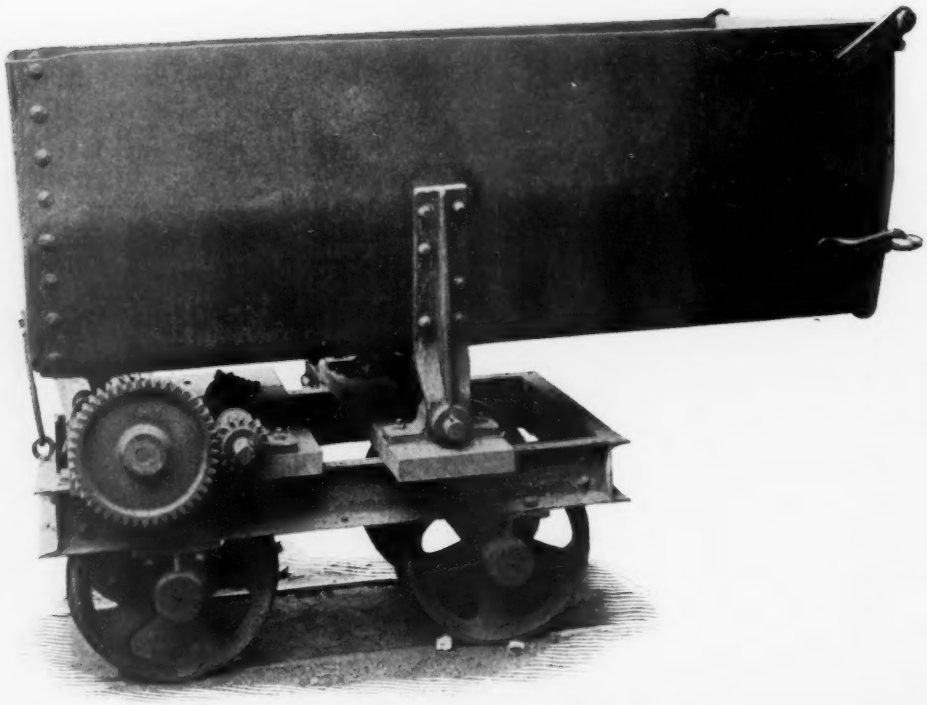
Among the leading manufacturers of Milwaukee is the Vilter Mfg. Co., which has one of the largest and best equipped plants of its kind in the country. This had its beginning in 1867, when Peter Weisel started the business in a very small way, being joined by Mr. Ernest Vilter in 1879, the house and material shop is three stories in height, 60x60 feet, and the pipe shop adjoining, 60x120 feet. In the latter all coils and pipe connections are made for the pipe systems employed in refrigerating and ice-making plants. The blacksmith shop is 60x60 feet and the stock room connected therewith 45x60 feet. Some distance from this is the power house 60x100 feet and the



ARRANGEMENT OF CUPOLA AND METHOD OF HANDLING MELTED IRON.

Weisel & Vilter Mfg. Co. being incorporated in 1886. Mr. Vilter died in 1888, when the business was carried on by his sons, who acquired Mr. Weisel's interests and changed the name of the corporation to that of the Vilter Mfg. Co. in 1893. During the great fire of 1892, when much of the city was destroyed, the company suffered the loss of its entire plant, when its operations were transferred to the present site, which is occupied by a machine shop, 80x417 feet, two stories in height, equipped with modern tools and two electric traveling cranes of 15 tons capacity each. The store foundry 110x270 feet. There has also lately been added a carpenter shop 44x144 feet, two stories in height, which is used for repairing flasks and making the woodwork for ice tanks and other fixtures.

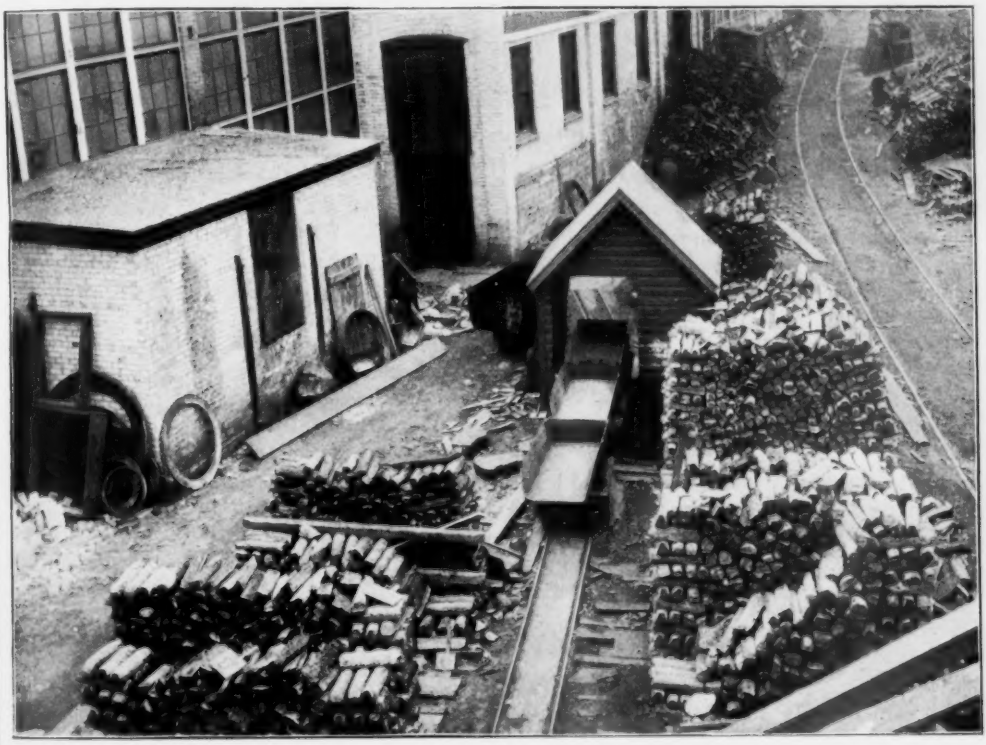
For many years the Vilter Mfg. Co. purchased its castings until its requirements in this line became so extensive that satisfactory deliveries could not be obtained from outside concerns, when the addition of this department was decided upon. It is built of brick and steel construction in a very substantial manner and careful attention has been paid to light and ventilation. The



SELF-DUMPING CAR FOR HANDLING COKE.

CHARGING CAR READY TO DISCHARGE ITS CONTENTS INTO THE CUPOLA.

main foundry, having a span of 60 feet, is served by two electric traveling cranes of 60,000 pounds and 15,000 pounds capacity, while the side floor is provided with trackage intended for a 15-ton crane. There are several features connected with the arrangement of the cupolas and stockyard, which are well worth describing. In the majority of foundries the cupolas are so located that the smoke, steam and dust arising from their operation find their way into the foundry proper. At the plant of the Vilter Mfg. Co. these annoyances are avoided by shutting off the cupola room through counterweighted doors, clearly shown in the accompanying illustration. Naturally these doors may be left open, except during such periods as when ladles are being dried, the cupola bottom dropped or other work being done, which makes smoke or steam. There is another thing connected with the cupolas as here located that should appeal with special force to every foundryman who likes to have his shop as clean as possible. This is the method adopted of handling iron in large or small ladles. In most foundries, when large ladles have to be filled, a hole has to be dug in the floor, and the way small ladles of iron are caught is in many instances absolutely dangerous, and the wonder is that molders and helpers do not receive worse burns than they do. In the foundry of the Vilter Mfg. Co. the cupola spout is located high enough so that the largest ladle may be inserted under same without disturbing the foundry floor in any particular. This of course leaves the spout too high to permit of tapping iron into smaller ladles after the ordinary "catch over" fashion. To accommodate work which has to be poured with small ladles, a mixing ladle is mounted on a permanent carriage, and attached to the standards, supporting the ladle, are fastened, at a convenient height, supports, upon which the shank of the bull ladle may rest while it is being filled. Thus there is no slopping or spilling of iron and the neat surroundings of the cupolas is a distinct revelation to

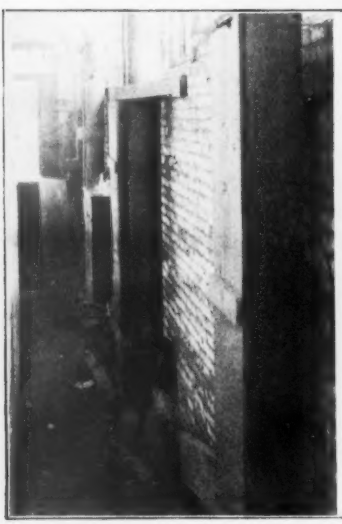


A PORTION OF STOCKYARD AND SCALE HOUSE.

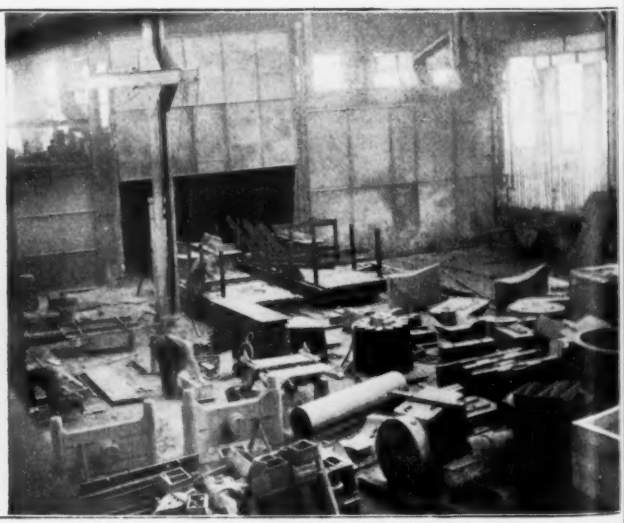
CAST IRON CURBING EMPLOYED WHERE LARGE MOLDS ARE MADE IN THE FLOOR.

those who have been accustomed to the ill kept conditions of older shops. Of course the mixing ladle with its load of metal may be run to one side of the track and emptied at leisure, while a larger ladle is being filled for heavy castings. Other ladles of different capacities may also be placed on trucks and run under the cupola spout and filled and shifted to the side floor or other parts of the foundry, thus giving the electric traveling crane a chance to be used for other purposes, instead of being tied up permanently with a ladle.

In the handling of material for the cupolas the Vilter Mfg. Co. has also introduced improvements calculated to avoid errors and reducing the cost of labor. An industrial track connects all parts of the stock yard, special cars being provided for handling iron and coke. The tracks do not extend beyond the elevator as the floor of the charging platform is covered with diamond steel plates and the cars may with ease be operated on any part of same without the necessity of providing trackage of any kind. Our illustrations show the designs of cars employed and it should be noted that the charges of iron are made up on each car, and by a tilting arrangement charged directly into the cupola without further handling. As will be seen in the illustration the cupola is furnished with a



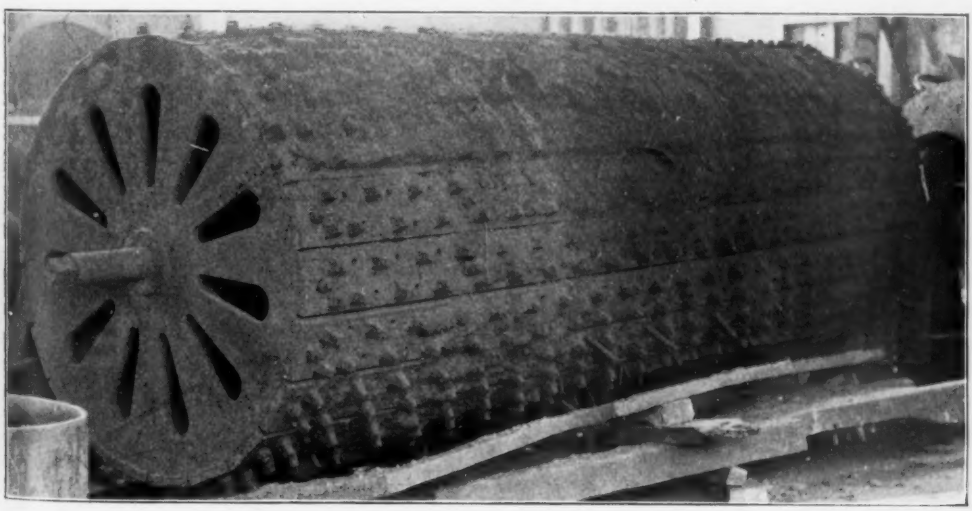
AIR HOISTS AT REAR OF OVENS FOR OPERATING CORE OVEN DOORS.



CORE OVENS AND FLOOR FOR HEAVY CORES.

A PART OF THE VILTER MFG. CO.'S PATTERN SHOP.

counterweighted door, moving in vertical guides, and a kind of a special shelf is also attached to the cupola, which protects the lining against jars it might receive from the spout of the charging cars, when the latter is being tilted. These cars are light enough so that they may readily be "jumped off" the track and run out of the way when not needed. A scale house has been placed in the yard so that weights may readily be



BUILT UP CORE BARREL FOR LARGE CYLINDER CORES.

SIDE FLOOR IN THE VILTER FOUNDRY.

ascertained without loss of time or the retracing of any movement in the handling of material.

Where large molds are to be made in the floor the foundries of this vicinity employ a cast iron curbing, the appearance of which is shown in the illustration. This fences off the mold proper and avoids many of the careless accidents which are apt to occur where the mold is made in the floor without any definite boundary. Again this form of curbing permits of the mold being made within a relatively smaller compass and it may be extended above the floor any distance which is considered convenient. The added security which is obtained in more ways than one compensates for the time required to adjust the curbing.

The core ovens at the Vilter Mfg. Co.'s foundry are located at one end of the foundry and are large and roomy. All firing is done at the rear, where are also located the air hoists by which the doors of the ovens are operated. This is a rather novel application of the air hoist, although none will deny that it gives the very best of satisfaction. It is argued that the relatively small cost of one of these air hoists, by which any boy may open or close the doors, will soon pay for itself, through the time saved in laborers' help. One of the illustrations shows a large built-up core barrel, such as is used in making large cylinders

SOLID CORE BARREL EMPLOYED TO PRODUCE A CLOSE-GRAINED SURFACE ON CASTINGS.

These core barrels are not to be confounded with barrels used for loam cores, as in this instance nothing but ordinary core sand is employed, in fact they belong to that class of core barrels used for green sand cores. They are reinforced at several points throughout their interiors by castings similar to the end-pieces. It had always been the writer's opinion that a hard unyielding core of this kind did not permit of as free a contraction of the casting as is necessary to avoid shrinkage strains, however I was informed that there had never been any trouble experienced through using cores of this kind, and of course practice beats all theories one may hold. There are a great many things done in the foundries of the country which apparently defy all laws experience has laid down for guidance of the trade. Sometime ago our columns contained an article from the late Mr. Jewett in which he recited the experiences of a certain foundry which had tried to cast the interior of a cylinder on a chill without success. Yet this is practically accomplished in Milwaukee foundries. With this is shown an illustration of what appears to be a core barrel, built up of eight cast iron staves, assembled on cast iron flanges. It will be noted that the staves join at an angle and between each is inserted a strip of heavy cardboard, as there is also between the flanges and that part of the staves coming in contact with these. The theory is of course that these pieces of card board will burn away and thus allow the casting some degree of shrinkage. Making a casting after this manner, while it naturally aids in obtaining a close grain, does not chill the iron as much as one would believe, partly due to the fact that the staves forming the chill are relatively light. Another point learned by experience is that the latter last but a few times before they become warped and have to be replaced by new staves if the casting is expected to show a uniform diameter.

The foundry of the Vilter Mfg. Co. is heated by hot air, although it will be noted from the illustrations that there is an entire absence of pipes, so common where this system is adopted. In this instance the heat is distributed through underground conduits and enters the building through registers placed in the walls of same, thus giving the colder parts of the shop the benefit of the greatest volume of heat, whereas in places where the heat is distributed through a central pipe, these parts of the shop may have a low temperature, although the balance of the works may be fairly comfortable. The greater part of the works of the Vilter Mfg. Co. has been in continuous operation, night and day, for seven years and the output has found its way to all parts of the world. In addition to manufacturing Corliss engines the principal product of the Vilter Mfg. Co. is complete equipments for ice making and refrigerating plants, also brewers' and bottlers' machinery. Mr. Edward Weber is foreman of the foundry.

The Malleable Iron Industry of the United States and Canada.

Perhaps no branch of the foundry trade can show as rapid an increase in capacity as the malleable iron industry.

The past three or four years have witnessed an increased activity in this line and as we are often in receipt of inquiries asking for particulars in regard to the extent of the manufacture of malleable iron in the United States and Canada, we append herewith a list of the concerns engaged therein on January 1st, 1903, arranged according to States. We also show the class of work turned out by each, as well as the daily capacity of individual plants where this has been obtainable. Where the capacity is followed by an asterisk (*), this is to indicate that the figures quoted are estimated.

ALABAMA.

Southern Car & Foundry Co., Anniston, Ala. Principal output, car castings, all consumed by the company's plants. Daily capacity, 15 tons.

CONNECTICUT.

Malleable Iron Fittings Co., Branford, Conn. Product, pipe fittings and general castings. Daily capacity, 30 tons.

Bridgeport Malleable Iron Co., Bridgeport, Conn. Output, general castings. Daily capacity, 40 tons.

Walter W. Woodruff & Sons Co., Mount Carmel, Conn. Output, carriage hardware. Daily capacity, 2 tons.

Naugatuck Malleable Iron Co., Naugatuck, Conn. Output, general castings. Capacity, 35 tons daily.

Malleable Iron Works, New Britain, Conn. Output, general castings. Capacity, 5 tons per day.

North & Judd Mfg. Co., New Britain, Conn. Output, hardware castings, consumed by company. Daily capacity, 6 tons.

Vulcan Iron Works, New Britain, Conn. Output, general castings. Capacity, 7 tons daily.

The W. & E. T. Fitch Co., New Haven, Conn. Principal output, saddlery hardware castings, consumed by company. Capacity per day, 2½ tons.

Andrew Terry Co., Terryville, Conn. Product, light hardware castings. Daily capacity, 4 tons.

DELAWARE.

Wilmington Malleable Iron Co., Wilmington, Del. Output, general castings. Capacity, 20 tons per day. (Now being enlarged.)

ILLINOIS.

Parlin & Orendorff Co., Canton, Ill. Product, agricultural castings, of which 75 percent is consumed by the company. Capacity, 24 tons daily.

Chicago Malleable Castings Co., West Pullman (Chicago) Ill. Output, railroad, agricultural and general castings. Capacity per day, 30 tons.

Crane Co., Chicago, Ill. Product, pipe fittings and specialties. Capacity, 50 tons daily

Illinois Malleable Iron Co., Chicago, Ill. Output, pipe fittings and specialties. Capacity, 15 tons daily, which will shortly be increased to 25 tons.

International Harvester Co., (Deering Division) Chicago, Ill. Output, agricultural castings, consumed by the company. Daily capacity, 65 tons. (See also Springfield, Ohio.)

International Harvester Co., (McCormick Division), Chicago, Ill. Product, agricultural castings, consumed by company. Capacity, 40 tons daily. (See also Springfield, Ohio). Extensions are now under way which will practically double present capacity.

National Malleable Castings Co., Chicago, Ill. (See also Toledo, O., Cleveland, O., and Indianapolis, Ind.) Output, general castings. Capacity of two old foundries and Grant works, 230 tons daily.*

Railroad Supply Co. (Central Malleable Works), Chicago, Ill. Principal output, railway castings. Capacity, 20 tons daily.

Central Malleable Iron Co., Decatur, Ill. Output, agricultural castings. Daily capacity, 20 tons.

Missouri Malleable Iron Co., East St. Louis, Ill. Product, general castings. Capacity, 50 tons daily.

American Malleable Iron Co., Chicago Highlands, Ill. (Main office, Marquette Bldg., Chicago). Principal product, railroad and agricultural castings. Daily capacity, 30 tons.

Forster, Waterbury & Co., Franklin Park, Ill. Output, link chains, malleable specialties and general castings. Capacity, 25 tons daily.

Western Steel Car & Foundry Co. (Lessees, Illionois Car & Equipment Co.), Hegewisch, (Chicago) Ill. Product, car castings, consumed by company. Daily capacity, 10 tons.

William E. Pratt Mfg. Co., Joliet, Ill. (Main office, Chicago.) Output, hardware specialties and general castings. Daily capacity, 10 tons.

Western Tube Co., Kewanee, Ill. Product, pipe fittings. Daily capacity, 20 tons.

American Car & Foundry Co., Madison, Ill. Output, car castings, consumed by the company. Capacity, 12 tons per day. (See also St. Charles, Mo.)

Union Malleable Iron Co., Moline (East Moline) Ill. Output, general castings. Capacity, 30 tons daily.

Ellington Mfg. Co., Quincy, Ill. Output, general castings. Daily capacity, 10 tons.

Rockford Malleable Iron Co., Rockford, Ill. Chief product, agricultural castings. Capacity, 15 tons daily.

Moline Malleable Iron Co., St. Charles, Ill. Output, general castings. Daily capacity, 15 tons.

INDIANA.

National Malleable Castings Co., Indianapolis, Ind. Product, general castings. Capacity, 60 tons daily.* (See also Chicago, Ill., Toledo, O., Cleveland, O.)

Marion Malleable Iron Co., Marion, Ind. Output, general castings. Capacity, 20 tons daily.

Whiteley Malleable Castings Co., Muncie, Ind. Output, agricultural and railroad castings. Capacity, 75 tons daily.

Oliver Chilled Plow Works, South Bend, Ind. Output, plow castings, consumed by the company. Capacity, 15 tons daily.

South Bend Malleable Iron Co., South Bend, Ind. Product, general castings. Daily capacity, 15 tons.

MARYLAND.

Baltimore Malleable Iron & Steel Casting Co. (P. Kennedy, owner), Baltimore, Md. Product, general castings. Capacity, 25 tons daily.

MASSACHUSETTS.

Belcher Malleable Iron Co., Easton, Mass. Product, light castings. Capacity, 2 tons daily.

Arcade Malleable Iron Co., Worcester, Mass. Product, general castings. Capacity, 5 tons per day.* (Also own Worcester Malleable Iron Co.)

Worcester Malleable Iron Works, (Arcade Malleable Iron Co., owners), Worcester, Mass. Product, general castings. Daily capacity, 4 tons.*

MICHIGAN.

Albion Malleable Iron Co., Albion, Mich. Output, agricultural and general castings. Capacity, 25 tons daily.

Michigan Malleable Iron Co., Delray, Mich. (near Detroit). Product, railway and agricultural castings. Capacity, 75 tons daily.

Buhl Malleable Co., Detroit, Mich. Output, railroad, agricultural and general castings. Capacity, 20 tons daily.*

Grand Rapids Malleable Iron Co., Grand Rapids, Mich. Product, general castings. Capacity, 20 tons daily.

Standard Malleable Iron Co., Muskegon, Mich. Product, general castings. Capacity, 20 tons daily.

Port Huron Malleable Co., Port Huron, Mich. Product, general castings. Capacity, 10 tons daily.

MINNESOTA.

Minnie Harvester Co., St. Paul, Minn. Product, agricultural and railroad castings. Capacity, 40 tons daily.

MISSOURI.

American Car & Foundry Co., St. Charles, Mo. Output, car castings, consumed by the company. Daily capacity, 15 tons. (See also Madison, Ill.)

NEW HAMPSHIRE.

Laconia Car Co., Laconia, N. H. (Main office, Boston, Mass.) Output, general castings. Daily capacity, 6 tons.

NEW JERSEY.

Arthur E. Barlow, Newark, N. J. Output, general castings. Capacity, 4 tons daily.

S. J. Meeker, Newark, N. J. Product, general castings. Capacity, 8 tons daily.

Trenton Malleable Iron Co., Trenton, N. J. Product, general castings. Daily capacity, 10 tons.

NEW YORK.

Page & Sill (Albany Malleable Iron Works), Albany, N. Y. Output, general castings. Capacity, 5 tons daily.

D. M. Osborne & Co., Auburn, N. Y. Output, agricultural castings, consumed by the company. Capacity, 25 tons daily.

Acme Steel & Malleable Iron Works (E. G. Felthousen, owner), Buffalo, N. Y. Product, general castings. Capacity, 20 tons daily.

Pratt & Letchworth Co. (Buffalo Malleable Iron & Steel Works), Buffalo, N. Y. Product, railway castings. Capacity, 45 tons daily. (See also Brantford, Ontario.)

Gould Coupler Co., Depew, N. Y. Product, car couplers, journal boxes and draft arms. Daily capacity, 90 tons.

Deposit Foundry Co., Deposit, N. Y. (George M. Ballard, Newark, N. J., owner). Output, harness and general castings. Capacity, 2 tons daily.

Walter A. Wood Mowing & Reaping Mach. Co., Hoosick Falls, N. Y. Product, agricultural castings, consumed by the company. Daily capacity, 25 tons.*

Lancaster Malleable Iron Works, Lancaster, N. Y. Product, general castings. Capacity, 20 tons daily.

Oriskany Malleable Iron Co., Oriskany, N. Y. Product, general castings. Capacity, 4½ tons daily.

Isaac G. Johnson Co., Spuyten Duyvil, N. Y. Output, general castings. Capacity, 15 tons daily.

Frazer & Jones Co., Syracuse, N. Y. Product, saddlery and hardware castings. Capacity, 9 tons daily.

Syracuse Malleable Iron Works, Syracuse, N. Y. Output, general castings. Capacity, 10 tons daily.*

Torrance Iron Co., Troy, N. Y. Product, general castings. Capacity, 5 tons daily.*

Troy Malleable Iron Co., Troy, N. Y. Output, general and railroad castings. Capacity, 10 tons daily.*

Westmoreland Malleable Iron Co., Westmoreland, N. Y. Output, general castings. Capacity, 4 tons daily.

OHIO.

Canton Malleable Iron Co., Canton, O. Product, general castings. Capacity, 18 tons daily.

Elbel Co., Canton, O. Product, saddlery and harness hardware castings, consumed by the company. Capacity, 5 tons daily.

Haven Malleable Casting Co., Cincinnati, O. Output, general castings. Capacity, 10 tons daily.

Dayton Malleable Iron Co., Dayton, O. Product, agricultural and general castings. Capacity, 75 tons daily.

Acme Mfg. Co., Lancaster, Ohio. Product, general castings. Capacity, 5 tons daily.

Chisholm & Moore Mfg. Co., Cleveland, O. Product, general castings. Capacity, 15 tons daily.

Eberhard Mfg. Co., Cleveland, O. Product, carriage, saddlery and hardware specialties. Capacity, 40 tons daily.

National Malleable Casting Co., Cleveland, O. Product, agricultural, railway and general castings. Capacity, 60 tons daily.* (See also Toledo, O., Indianapolis, Ind., Chicago, Ill.)

Buckeye Malleable Iron & Coupler Co., Columbus, O. Principal output, car couplers and other railway castings. Capacity, 50 tons daily.

Columbus Malleable Iron Co., Columbus, O. Output, general castings. Capacity, 15 tons daily.

P. Hayden Saddlery Hardware Co., Columbus, O. Output, harness and saddlery hardware. Daily capacity, 3 tons.

Ohio Malleable Iron Co., Columbus, O. Product, chain link, car couplers and medium weight castings. Capacity, 20 tons daily.

Marion Malleable Iron Co., Marion, O. Product, general castings. Capacity, 5 tons daily.

International Harvester Co. (Champion Division). Springfield, O. Product, agricultural castings, consumed by the company. Capacity, 50 tons daily. (See also Chicago.)

Springfield Malleable Iron Co., Springfield, O. Product, railroad, agricultural and general castings. Capacity, 35 tons daily.

National Malleable Castings Co., Toledo, O. Product, agricultural, railway and general castings. Capacity, 60 tons daily.* (See also Cleveland, O., Indianapolis, Ind., Chicago, Ill.)

Zanesville Malleable Iron Co., Zanesville, O. Product, general castings. Capacity, 20 tons daily.

PENNSYLVANIA.

Altoona Foundry & Machine Co., Altoona, Pa. Product, railroad and general castings. Capacity, 10 tons daily.

Berwick Malleable Co., Berwick, Pa. Output, general castings. Capacity, 20 tons daily.

Sterlingworth Railway Supply Co., Easton, Pa. Product, car truck and bolster castings, consumed by the company. Capacity, 20 tons daily.

Erie Malleable Iron Co., Erie, Pa. Product, general castings. Daily capacity, 60 tons.

Jarecki Mfg. Co., Erie, Pa. Product, fittings and hardware specialties. Daily capacity, 18 tons.

Franklin Rolling Mill & Foundry Co., Franklin, Pa. Output, special castings consumed by company and general castings to order. Capacity, 10 tons daily.

Huntingdon Malleable Iron Co., Huntingdon, Pa. Output, general castings. Capacity, 6 tons daily.

Fort Pitt Malleable & Gray Iron Works, McKee's Rocks, Pa. (Main office, Pittsburg, Pa.) Product, general castings. Capacity, 20 tons daily.

Pennsylvania Malleable Co., McKee's Rocks, Pa. Output, car castings. Capacity, 80 tons daily.

Meadville Malleable Iron Co., Meadville, Pa. Output, general castings. Daily capacity, 20 tons.

Thos. Devlin & Co. (National Hardware & Malleable Iron Works), Philadelphia, Pa. Output, fittings and hardware specialties. Capacity, 10 tons daily. (See also "New Construction.")

Stanley G. Flagg & Co., Philadelphia, Pa. Product, malleable pipe fittings and general castings. Capacity, 10 tons daily. (See also Pottstown, Pa.)

Philadelphia Hardware & Malleable Iron Works, Philadelphia, Pa. Product, hardware specialties. Capacity, 8 tons daily.

McConway & Torley Co., Pittsburg, Pa. Product, car couplers and general castings. Daily capacity, 65 tons.

Pittsburg Malleable Iron Co., Pittsburg, Pa. Product, general castings. Capacity, 30 tons daily.

Stanley G. Flagg & Co., Pottstown, Pa. Product, malleable pipe fittings and general castings. Daily capacity, 20 tons. (See also Philadelphia, Pa.)

Norway Iron & Steel Co., York, Pa. Output, general castings. Capacity, 50 tons daily.

York Mfg. Co., York, Pa. Output, general castings. Daily capacity, 10 tons.

RHODE ISLAND.

Rhode Island Malleable Iron Works, Hills Grove, R. I. Product, general castings. Daily capacity, 10 tons.

TENNESSEE.

Ross-Meehan Foundry Co. (Southern Malleable Iron Works), Chattanooga, Tenn. Output, railroad and agricultural castings. Capacity, 30 tons daily.

WEST VIRGINIA.

West Virginia Malleable Iron Co., Point Pleasant, W. Va. Output, general castings. Capacity, 25 tons daily.

WISCONSIN.

Beaver Dam Malleable Iron Co., Beaver Dam, Wis. Product, railroad and agricultural castings. Capacity, 20 tons daily.

Milwaukee Malleable & Gray Iron Works, Milwaukee, Wis. Product, general castings. Capacity, 10 tons daily.

Northwestern Malleable Iron Co., Milwaukee, Wis. Product, agricultural and railroad castings. Daily capacity, 80 tons.

West Allis Malleable Iron & Chain Belt Co., West Allis (Milwaukee), Wis. Product, detachable chain belting and accessories, and custom work. Daily capacity, 10 tons.

Wisconsin Malleable Iron Co., Milwaukee, Wis. Output, general castings. Capacity, 50 tons daily.

Ferris Clevis Co., Oshkosh, Wis. Output, patented clevises. Capacity, 5 tons daily.

Belle City Malleable Iron Co., Racine, Wis. Product, agricultural and railroad castings. Capacity, 30 tons daily.

Lakeside Malleable Iron Co., Racine, Wis. Product, general castings. Daily capacity, 18 tons.

Racine Malleable & Wrought Iron Co., Racine, Wis. Output, saddlery hardware castings. Capacity, 20 tons daily.

Stowell Mfg. & Foundry Co., South Milwaukee, Wis. Product, agricultural, wagon malleables and hardware specialties. Capacity, 20 tons daily.

Waukesha Malleable Iron Co., Waukesha, Wis. Output, general castings. Capacity, 15 tons daily.

CANADA.

Pratt & Letchworth Co., Brantford, Ontario. Output, agricultural and railroad castings. Capacity, 25 tons daily. (See also Buffalo, N. Y.)

Taylor-Forbes Co., Guelph, Ontario. Product, hardware specialties and general castings. Capacity, 2 tons daily.

Patrick Kyle, Merrickville, Ont. Product, general castings. Capacity, 3 tons daily.

Ontario Malleable Iron Co., Oshawa, Ont. Output, general castings. Capacity, 20 tons daily.

St. Catharines Malleable Iron Works (McKinnon Dash & Metal Works Co., owners), St. Catharines, Ont. Product, hardware specialties and general castings. Capacity, 10 tons daily.

Walkerville Malleable Iron Co., Walkerville, Ont. Product, railroad and agricultural castings. Daily capacity, 25 tons.

Smiths Falls Malleable Iron Co. (W. H. Frost, owner), Smiths Falls, Ontario. Product, general castings. Daily capacity, 20 tons.

In tabulated form the malleable industry makes the following showing:

	No. of Works.	Daily Capacity, Tons.
Alabama	1	15
Connecticut	9	131½
Delaware	1	20
Illinois	20	721
Indiana	5	185
Maryland	1	25
Massachusetts	3	11
Michigan	6	170
Minnesota	1	40
Missouri	1	15
New Hampshire	1	6
New Jersey	3	22
New York	15	289½
Ohio	17	486
Pennsylvania	18	467
Rhode Island	1	10
Tennessee	1	30
West Virginia	1	25
Wisconsin	11	278
Canada	7	105

Total, 123 works, with a daily capacity of 3,052 tons.

All of the works mentioned above are in active operation and according to the figures given represent an annual capacity of 915,600 tons. It is well known, however, that even under the best of management no concern ever attains its maximum capacity and the actual output of malleable castings in the United States and Canada is probably between 750,000 and 800,000 tons. The work capacity as here used should in no way be mistaken for output, as it is evident that many foundries have rated their capacity according to the amount of iron they are capable of melting or annealing. With a heavy class of castings a foundry may show nearly double the output it could if making light castings, and the tonnage it is capable of handling therefore depends upon factors which are not readily ascertainable.

The three States of Illinois, Ohio and Pennsylvania produce over 54 per cent of the total tonnage of malleable iron. If we add the States of New York, Wisconsin and Indiana, we cover more than 80 per cent of the total output of malleable castings.

NEW CONSTRUCTION.

In addition to the concerns listed above and in active operation there should be mentioned:

St. Paul Foundry Co., St. Paul, Minn. A malleable iron department with a capacity of 25 tons per day is expected to be in operation by the end of the year.

St. Louis Malleable Casting Co., St. Louis, Mo. Plant under construction and will be occupied about May 1 of this year. Output, general castings. Capacity, 40 tons daily.

Thos. Devlin & Co., Burlington, N. J. Plant nearly completed and expected to be in full operation early in the year. Output, fittings

and hardware castings. Capacity, 20 tons daily. (See also Philadelphia, Pa.)

Columbia Machine Works & Malleable Iron Co., Brooklyn, N. Y., intend to add a malleable department to their plant.

The Ohio Brass Co., Mansfield, O., have under consideration the building of a malleable plant with from 15 to 20 tons daily capacity.

Rhodes, Curry & Co., Amherst, N. S., Canada, may possibly erect a malleable plant during the year 1903.

Canadian Pacific Ry. Co. have planned a malleable department to be operated in connection with the new shops of the company now being erected at Hochelaga, a suburb of Montreal, P. Q.

Among other companies incorporated to manufacture malleable castings are:

The Colorado Foundry Co., Pueblo, Colo.

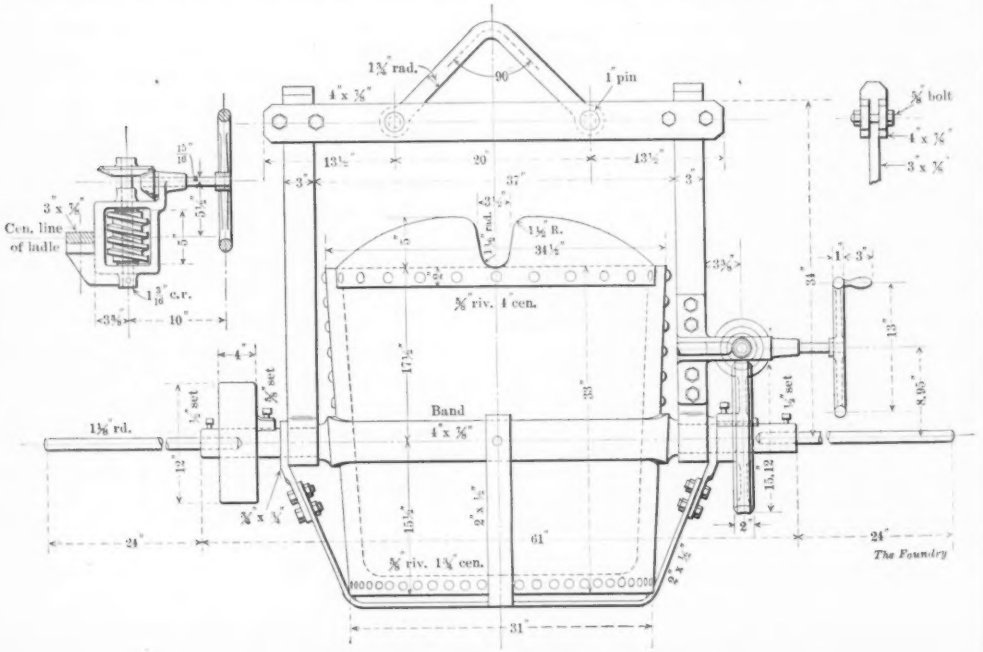
Chicago Heights Malleable Iron Co., Chicago Heights, Ill.

National Malleable Iron & Steel Perfection Coupler Co. (office 420 Walnut St., Philadelphia.) Plant being fitted up at Spring City, Pa.

A 5,000 Pound Foundry Ladle.

The ladle illustrated herewith is designed to have a capacity of 5,000 pounds of iron when provided with a 1½ inch lining around the sides and a 2-inch lining on the bottom, allowing about 3 inches in the upper part of the ladle to prevent spilling of metal. The inside dimensions are as follows: Diameter at top 34½ inches, at bottom 31 inches, depth 33 inches. The sides are made from ¼-inch tank steel, and may be gotten out of two plates ¼x35x57 inches. The bottom is of 5-16-inch steel and is flanged from a head 5-16x35 inches in diameter. The two side seams are lapped and single riveted with ⅝-inch rivets, 2½ inch centers, the rivets below the trunnion band being countersunk on the outside so as to permit of the band being slid on. The girth joint is single riveted with ⅝-inch rivets, 1¾ inch center. Twelve ⅜-inch vent holes are punched in the bottom prior to flanging.

The principal forging is the band with attached trunnions, the latter being made from 2¾-inch round steel turned to 2 9-16 inches. In order to allow for the taper of the bowl, the 4x7⅛-inch bar for the band is first curved on the edge, so that the middle ordinate is about 6½ inches. The bar is then rolled to the proper diameter and welded, after which the trunnions are forged on. The uprights are made from 3x7⅛-inch steel, the trunnion bearing at the lower end being forged from heavier stock to allow for forging and boring out. The cross bars are made from 4x⅞-inch steel, and the bail forged from 1⅜-inch



DESIGN FOR 5,000 POUND CRANE LADLE.

round steel with flattened ends drilled for 1-inch pins. The trunnion ends are bored to receive ordinary 1⅛-inch round iron for steadying bars, which are held in place by set screws.

The ladle is operated by a hand wheel, with projecting handle, shown on the right hand side. A pair of bevel wheels reduce this speed, 2:1 and communicates the motion to the worm gear, directly above the worm wheel, which is keyed on one of the trunnions. This step makes a further reduction of 36:1. This gearing is attached to, and held together by, a simple cast iron frame, which may be fitted up complete, placed and clamped in position before the bolt holes are drilled. For one-quarter turn of the ladle upon its trunnions, eighteen turns of the hand wheel are necessary. Further details connected with this gearing may be mentioned as follows: Bevels, 12 and 24 teeth, ¾-inch circular pitch; worm, single thread, 1¼ pitch; pitch diameter of bevels are 5.73 inches and 2.86 inches; face 1½ inches; pitch diameter of worm wheel 14.32 inches; minimum outside diameter 15.12 inches; pitch diameter worm 3.58; outside diameter of worm 4⅜ inches; total depth of teeth .858 inches; width of space at bottom of teeth .387 inches; angle of teeth 29 degrees. All the gearing in this particular instance had ordinary cast teeth.

In order to counterbalance the weight of the gearing, a cast iron weight 12 inches in diameter, and 4 inches face, weighing about 125 pounds is placed on the opposite side. If balancing is not deemed a matter of advantage, the bail may be set slightly over to one side, which will make the balance depend upon the amount of iron carried in the ladle; the complete weight of which is about 1,150 pounds. This particular combination of cross bars and uprights, though not at all uncommon now, originated, I believe, with the United States government.

J. F. PALMER.

Cost Keeping in Foundries.

Referring to Mr. MacDowell's article in the March issue of THE FOUNDRY it seems to me as if his system of cost keeping is too elaborate to be kept at a cost of 50 cents per day for clerk hire. His various cards and reports at first glance seem to cover the ground and give the cost of castings, but on closer inspection they fall short of furnishing accurately such information, in my opinion.

If the molders' time card, shown in form No. 1, was to be filled out by a molder, like some I have seen, it would be worth nothing at all, but as Mr. MacDowell's molders work by the piece he probably secures more accurate information. Analyzing the items in this card it is of no value to know the hours, when a molder is working by the piece. The number and kind of castings are of little use, for one or all may be found bad when the castings are cleaned, besides no space has been set aside for a discount. The molder cannot give the weight of the casting, the best he can do is to guess at it. Therefore this card as filled out by the molder is of no use in figuring the cost of castings. In order to make this card of value another card must be filled out in the cleaning room for each molder, showing discount and weight of castings.

Following this kind of a system a separate card has to be provided every day for each molder, and a shop employing a hundred hands would require about 30,000 cards annually. Taking in a similar set of cards for the cleaning room, 60,000 cards would be needed yearly to carry out this system. If these are preserved for reference they will soon take up considerable room. In order to find a molder's standing great numbers of these would have to be handled, and in the long run this will be found a rather inconvenient and expensive system of ascertaining the cost of castings. A more convenient and less expensive way would be to do away with the cards entirely and instead utilize books which may be arranged somewhat as follows:

Date.	Hours.	Mr..... March, 1903.	Cause of bad Castings.	Mold. No. Pieces.	Discount, No. Pieces.	Weight, Good Castings.
2	10	Pattern No. 1, Order No. 6	Molding	10	2	400
3	9	Pattern No. 6, Order No. 2	Hard iron	8	1	500
4	10	Gear Wheels, Stock.....	Dirt	6	1	300
5	10	Molding Engine Bed.....	.....	.....	.....	.....
6	10	" " "	.....	.....	.....	.....
7	10	Engine Bed.....	.....	1	.....	4,000
9	10	Pulleys 4 x 16, Order No. 10..	Arms crack'd	10	3	200

This form may be adapted to any class of castings and by giving each molder a page this will show at a glance what he has accomplished. It also shows the number of castings made, whether made to fill special orders or for stock, and from this and other items the cost of his castings may be figured and leaks found.

To keep this account accurate a clerk should be sent into the foundry to count the castings before they are removed from same, and each molder should be credited with the number

he has molded. The discounts and weights should be obtained in the cleaning room as soon as they are cleaned. A page of any size may be used, but the book should not be too large, for a foundry is not a very clean place and it is better to discard a small book as soon as it is full and obtain a new one. The form shown in No. 2 may be filled out from the molder's time and casting book if it is desired to have a daily report in a concentrated form.

Form No. 3 shows nothing but the cost for foundry foreman and labor, and this may be kept in a book similar to the molder's casting book if it is desired to show what every man works at each day, when the report may be added to form No. 2 as cost of foundry labor. Form No. 4 shows nothing of real value as no space is provided for figuring cost of iron mixtures. Good and bad castings have already been reported in form No. 2 and the other items are largely guess work. The other forms shown largely repeat what has already been shown on previous ones with perhaps a few items added.

From his reports Mr. MacDowell learns nothing but the cost of labor and weight of castings produced. This he may readily find from his pay roll and casting book in his office without extra expense when he has these things in two items. In all these reports he does not appear to be able to ascertain the cost of his mixture of iron from day to day. This is something which a properly made out cupola report should show. His items of labor in all departments all come under the heading of foundry labor and should be charged as such in one item. The same applies to supplies of various kinds, the cost of which must all be guessed at, for no founder can accurately tell the daily cost of every little thing he uses. If it is sought to reduce waste, this may as readily be done from the store room. Taking as a whole I do not believe Mr. MacDowell learns anything from the reports he shows which, as I said in my first article, he cannot obtain from accounts in his office. That is, time of workmen, report of castings made and orders filled. All other items in his reports are estimates of cost which if placed too low may lead to losses. Such estimates had better not be made and when a full and accurate cost of castings is desired resort must be had to the old method of taking stock for a given period. If Mr. MacDowell will try a molder's time and casting book I think he will find that he obtains a truer labor cost of castings from this than from other systems. EDWARD KIRK.

CAST IRON NOTES.

Devoted to inquiries from Practical Foundrymen on the subject of Melting and Using Cast Iron. Address all inquiries to W. J. KEEP, care of The Foundry.

RECOVERING IRON FROM CINDERS.

I have lately received so many inquiries regarding my method of recovering iron from the cinder of the cupola dump that I will describe it.

After the blast has been shut off and all of the melted iron has been drained from the cupola, make a dam on the floor in front of the cupola spout, about 4 inches high, enclosing a semi-circular space having a radius of about 4 feet. Let the melter lay a tapping bar across the spout and have three or four laborers, with a piece of old 1½-inch shafting about 8 feet long, ram in the breast. If the bottom and spout have been made right there will be no melted iron in the cupola, but run the ram back and forth to allow all to drain out. All of the liquid slag in the cupola will run into the enclosed space underneath the cupola spout and if there is any iron among this it will run through the slag and lie on the floor in the form of a slab which can be picked up the next morning. When the cupola has been emptied of all slag and iron, drop the bottom. I like to draw the refuse out from underneath the cupola, turning it over and cooling it down with water.

The next morning, there being no slag in the dump, the coke can be readily picked out and returned to the charging platform, to be used as the melter chooses, as it has been weighed once and charged to the melting of the previous day. The pieces of the cupola sand bottom are thrown to one side and all the iron that can be seen is picked up. All iron taken from the cupola dump, the pig bed or from the gangway, which is not bad castings is weighed up and charged as remelt or home scrap. All remaining small pieces of coke, iron or slag are shoveled up from the bottom and from all parts of the foundry and placed in boxes on the cupola platform. This includes skulls from the ladles which contain more or less iron.

When the last charge of iron has been placed in the cupola and the heat is near enough to the end to show that there will be no shortage of iron, throw into the cupola any shot iron that may be left over and all the refuse previously mentioned. The iron and slag will all

be melted at once and the small bits of coke will hold the blast down and insure hot iron.

All the finest shot iron is in this way saved, as well as all coke in the form of small pieces, and nothing is lost. There is no increased expense of handling, since the absence of slag gives less work in picking over the cupola dump; all the necessary labor connected with a cinder mill as well as the power to run it and general wear and tear is avoided. I have never used a magnetic separator, but I understand that after the cinders have been crushed they are run over a four or six-mesh screen to remove the sand and fine material before this reaches the magnetized portion of the machine. It is the fine particles that would pass through this screen, as well as all the balance, that my method will save. No outlay is necessary for an outfit and I am surprised that all founders have not adopted this method before this.

A FEW MORE WORDS REGARDING SULPHUR IN COKE.

In the last issue of Cast Iron Notes I neglected to say anything about lessening sulphur by means of some fluxes that are on the market. For this purpose there is no better flux than ferromanganese, which can be procured in lumps or granulated, as is desired. By adding this in lumps or granulated to the charges in the cupola to the extent of, say, two pounds of 80 per cent ferromanganese to each ton of iron, the castings will be softer and stronger and more free from blow holes. They will also contain less sulphur.

By placing the powdered or granulated ferromanganese in the bottom of the ladle and letting the metal run down upon this, the same result will be obtained. Adding to each charge of iron a small quantity of pig iron containing over 1 per cent of manganese will counteract many of the bad effects of sulphur. A small increase of manganese in the mixture will produce a more uniform grain of a dark gray color.

TAPPING SLAG.

Some foundries can make slag run quietly while in many other cases the blast will blow out of the slag hole, scattering mineral wool all over the foundry. Before the blast can come out of the slag hole it must turn downward after entering the tuyeres, when it burns out the coke bed at that part of the cupola and causes a strong blast to blow down upon the surface of the melted iron.

This causes the iron to settle faster at the back of the cupola and often makes the iron dull. This trouble is caused by the slag hole being placed too high or made too large. In a cupola having a very deep bed, in which the melted iron is allowed to accumulate until it nearly reaches the tuyeres before the slag is drawn off, the slag hole is closed until the slag rises above it. By then opening the slag hole just large enough for the slag to run out as fast as the iron accumulates there will be no sputtering. The hole will be closed when the iron is tapped.

In a cupola delivering a steady stream of iron, a slag hole must be low enough and so small that the slag will always be above it and yet run out as fast as it forms, when there will be no noise and no wind will be blown towards the melted iron. If a steady stream of slag runs down a sloping spout a crust will form on the surface and by lifting this for a few seconds it will harden, and in this way a hollow tube is made through which the fluid slag will run constantly without noise or sparking.

Some Peculiarities of Phosphor Bronze.

Phosphor bronze is a peculiar metal to work with. It is readily spoiled by overheating, prolonged or repeated melting or the presence of certain impurities. The best results are undoubtedly had with dry sand molds, but with care in manipulating the metal, uniformly good work can be obtained in green sand, provided the castings are not above medium weight. Some forty years ago the introduction of phosphor bronze as a commercial product initiated several new features in engineering. It soon became a formidable rival to steel for many purposes. Phosphor bronze was the forerunner of the modern non-corrosive, high-tension and anti-friction alloys, and even if it has been in some measure, superseded by later discoveries, the history of its uses and advantages over ordinary bronze would still be full of interest and instruction to the brassfounder.

As the introduction of phosphor matches marked a decided advance on the flint and steel period of human progress so did phosphor bronze, in its pristine purity, mark an epoch in the progress of the mechanical industries. When phosphor bronze was first introduced into the foundries, the molders did not understand the nature of the alloy and its best qualities were often destroyed through improper treatment. In spite of the very precise instructions issued with the metal, so many

flagrant abuses were common in the foundries that the Phosphor Bronze Company of Great Britain, to protect themselves and ensure fair conditions for their manufacture, were compelled to adopt a method of selling the metal by contract, in which they stipulated that the contracting brassfounder should bind himself to use it in a particular way (dry sand molds were preferred and feeders were considered desirable), and to cast it at a particular temperature, the casting heat being judged by the color of the molten metal and the condition of the "break." I can remember having one or two secrets in this connection imparted to me when I was an apprentice. I have learned a few more since then, but I am one who looks upon all trade practices as "open secrets."

Nevertheless I have been told in low breath and a powerful sense of the favor conferred, how to make my own phosphor bronze with copper, tin and pure phosphorus. You know the old style of making it with stick phosphorus, which has been steeped in a solution of copper sulphate, dried and enclosed in a tube and then gingerly inserted into the crucible containing the molten bronze. Very few brass founders are foolish enough to practice this primitive and uncertain method now that phosphor tin and phosphor copper containing any desired percentage of phosphorus may be had at reasonable prices.

The metalloids are beginning to play an important part in the refining and alloying of brassfounders' alloys, but there is still much to be done in the way of experiment and research. Phosphor, silicon and arsenic bronzes are simply modifications of the ancient metal of the bronze age. We have not had the limits of these elements defined nor a full statement of the properties conferred on metallic bodies by these non-metallic substances. It is expected that the electric furnace will yet solve many enigmas in the reduction of highly refractory or volatile metals, and in the manufacture of alloys. The improvements which have been made already in reducing aluminum and in refining zinc point in that direction.

The effect of phosphorus on the physical qualities of cast iron has always been thoroughly understood, but it is not generally known that phosphorus increases corrosion as well as induces "red-shortness." The properties and peculiarities of phosphorus when combined with steel, copper, bronze and babbitt metal are not so generally known as they might be. The following pointers should help to impress on brassfounders and others the right use of phosphorus in this connection:

Phosphor bronze is best melted in a crucible. When it is reduced to the molten condition in a brick lined furnace, the phosphorus attacks the silica in the lining, forming a slag which increases the waste both of metal and furnace lining.

Phosphor bronze shows a perfectly smooth surface on the ingot, and a characteristic granulation in the fracture. When molten it is easily distinguished by its fluidity, mirrorlike surface and the continuous "break" of the fluid metal until it sets.

Phosphor bronze does not assume a pasty condition just before setting. It passes suddenly from the fluid to the solid condition at a certain temperature. Many castings have been cast short owing to the metal being cooled too much and allowing it to freeze to the sides of the ladle while casting.

Phosphor bronze castings should not be dipped while still hot to blow the cores out. The phosphorus in the alloy renders it "red-short."

If you wish to see honeycombs all over the castings when they are machined, pour your phosphor bronze *hot, into unslicked green sand molds.* Many molders do this sort of thing and blame the bronze. The casting cleaner knows who to blame.

The best phosphor bronze does not necessarily contain the largest percentage of phosphorus. Phosphorus beyond the quantity required to produce homogeneous metal weakens the castings.

Phosphorus is a powerful deoxidizer, but an excess may create a worse evil than oxide. The recognized limit for cast iron is 1 per cent, for bronze 3 per cent; the less phosphorus there is in the finished metal the greater the resiliency of the bronze.

In steel 1-30 of one per cent phosphorus would render the metal valueless for edged tools.

Phosphorus introduced into ordinary bronze increases liquation and the tendency to segregation.

Phosphorus makes copper hard and *more* liable to corrosion, but added to bronze—copper and tin alloy—*less* liable to corrosion.

Phosphorus in bronze increases the grip of the "patina" or surface oxidation, so much sought after in ornamental bronzes.

Phosphorus in conjunction with zinc in a gun metal alloy increases the co-efficient of

friction; in conjunction with lead it reduces friction considerably. Kunzel was the first to deprecate the use of zinc in phosphor bronze. He patented an alloy which is now recognized as a splendid anti-friction metal for locomotive and other bearings liable to heat, viz.: Copper 66.5 to 91.5 per cent, lead 4 to 15 per cent, tin 4 to 15 per cent, phosphorus .5 to 3.5 per cent.

Phosphorus has great affinity for iron and acts to chemically combine brass and iron. This fact is largely taken advantage of by brass refiners to neutralize the bad effect of iron upon brass. For example, in refining borings, ashes or washings, which always contain iron, phosphorus is the agent which is commonly used to get the two metals, brass and iron, to amalgamate.

Phosphorus increases fluidity and fusibility and renders molten metal very limpid. On this account it is often introduced where delicate ornamental castings are required. Sometimes even in fine yellow brass work.

Phosphorus prevents blistering in babbitt metals and improves the anti-friction qualities of the metal.

If you tap a heat of gun metal before it is up to the proper heat, 5 per cent phosphorus will help to make it fluid, but it will not do what time and fuel would have done. It is a great mistake for brassfounders to rely upon phosphorus as a cure-all for dull metal simply because it helps to run the casting.

Castings in phosphor bronze never suffer from "cold-shut." Work your sand accordingly and you will be right. Carbuncles are a sign of disease somewhere—diagnose from the mold only.

When you wish to introduce phosphorus into the metal, don't wrap a piece in paper and make an exhibition of your agility in evading fireworks. A piece of phosphor copper will do the work much better.

J. F. BUCHANAN.

Making Pulley Wheels.

Sometime ago the foundry with which I am connected received an inquiry for a wheel 15 feet in diameter and 4 feet face to replace another one which had broken in shipment. We informed them that we had no pattern of this particular size, and they then asked the firm to send someone over to locate the cause of the casting breaking. I was detailed to attend to this and found a wheel in which the arms were brought up square against the rim without any fillets. My reason for calling the attention of the readers to this particular wheel is because I know that there are quite a number of foundries having their own machine shop who are in the habit of making the wheels after this style. It must be very evident that unequal shrinkage is set up in a wheel whose arms are connected to the rim without brackets or fillets of any kind. While all wheels made after this fashion may not break, still they must be working under more or less strain.

In my opinion the only way to overcome shrinkage strains is to remove the sand from around the outside of the casting as soon as this can be done after the casting is poured. This will allow the rim to shrink with the arms, otherwise the arms will shrink first and afterwards keep the rim from shrinkng as it should do. This may not result in the wheel cracking in the mold, but later on the casting may get a sudden jar, while being shipped or handled, and away goes the arms and this means another wheel at the foundryman's expense.

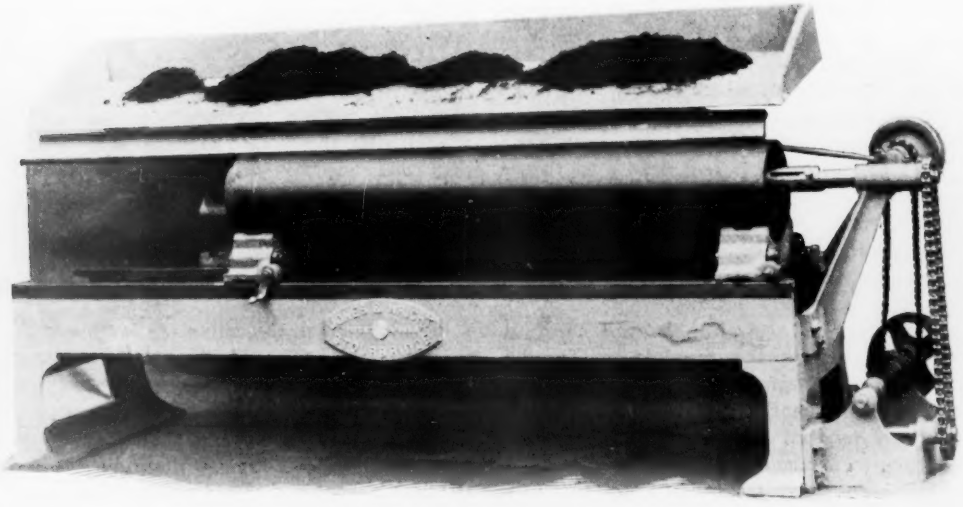
I recollect an instance where a wheel having hollow arms, all nicely proportioned, broke, clearly showing that arms had cooled off and later prevented the rim from shrinking. The expense caused by a defective casting of this character is so great that no one should begrudge the little extra labor which is required to dig around a casting, so as to promote even cooling. In wheels of large sizes something has got to be done to allow them to shrink properly, and I have given my opinion as to the best method of accomplishing this.

CHRIS METCALF.

A British Core Machine.

We illustrate with this a core machine recently patented by Mr. Walter Jones, of Jones & Attwood, Titan Works, Stourbridge, England. It is intended to make round cores for such castings as columns and pipes of various kinds. So far machines have been made which will make cores from 2 to 12 inches in diameter and from 1 to 9 feet long. By a slight adjustment of the movable steel bar shown in the illustration, tapered cores may be produced just as easily as cores of a uniform diameter.

Ordinary green sand is employed in making the cores. The working of the machine is exceedingly simple, a belt at the back giving a



THE JONES CORE MACHINE.

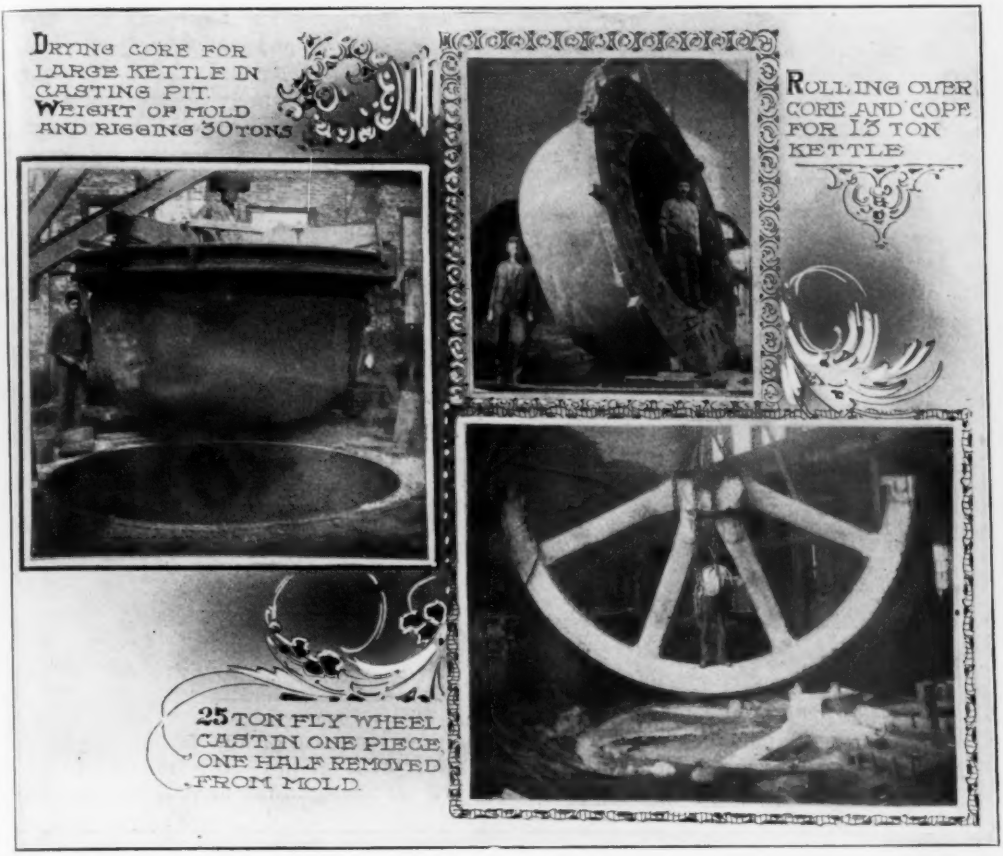
rotary motion to the core barrel by means of a chain drive. A second chain drive works directly from the main shaft and through a connecting rod a crank gives a reciprocating motion to the flat steel bar shown beneath the feed hopper. This bar being constantly moving presses the green sand firmly to the core barrel as it is fed by the workmen from the hopper. The thickness of the sand is kept as thin as possible, little or no drying of the core being necessary. Messrs. Jones & Attwood claim that the saving resulting from this method, over the usual loam cores used for pipes, ranges from 5 to 10 shillings per ton of castings. J. R. K.

Some Castings From the Foundry of the King & Andrews Co.

To make one of the large acid kettles, weighing from ten to fifteen tons, and have this come out of the mold without a flaw of any kind, shows good workmanship. Some time ago the King & Andrews Co., of Chicago Heights, Ill., received quite a large order for castings of this kind, the first ones of which were bedded in the floor and swept up in green sand and skin-dried. This involves considerable labor as the mold must first be given the shape of the interior of the kettle, so that the core and cope may be rammed up therefrom, and after this has been lifted away the drag part of the mold must be swept up again to conform to the exterior surface of the casting.

This method involves a solid core and a very heavy rigging and requires strong cranes to carry the weight of core and cope. One of the attached illustrations shows this suspended from the crane, the weight being thirty tons. Underneath the core and cope may be seen the casting pit, 12 feet deep, which in this instance was used as a drying oven, since the core fitted into this, and offered the most convenient way of skin-drying these molds.

Subsequently it was decided to make these castings in loam and it occurred to those having this matter in charge that the quality of these large kettles could be enhanced by devising a rigging, which would permit of the free shrinkage of the casting and avoid cracks or structural weakness, often caused by a solid, unyielding central core. To accomplish this the King & Andrews Co. fasten to the large loam plate eight sectional, orange-peel, frames which form the interior shape of the kettle. These eight pieces are clamped to the loam plate and to each other and are held apart to the extent of half an inch or so by wedges. When this frame is ready a coat of loam is swept thereon and dried, when the whole is rolled over after the method shown in another of the illustrations. It may here be stated that while the cope and core is being prepared the drag portion of the mold is being finished in a permanent brick pit, whose outlines are but little disturbed from one casting to another. After the mold has been poured and a reasonable time elapsed for the iron to become solid, but before the color of this has passed beyond a cherry heat, the wedges


DRYING CORE FOR LARGE KETTLE IN CASTING PIT. WEIGHT OF MOLD AND RIGGING 30 TONS
ROLLING OVER CORE AND COPE FOR 15 TON KETTLE
25 TON FLY WHEEL CAST IN ONE PIECE. ONE HALF REMOVED FROM MOLD.

SOME CASTINGS FROM THE FOUNDRY OF THE KINGS & ANDREWS CO.

are all released, allowing the orange-peel frames to collapse and the casting to contract without being subjected to the usual shrinkage strains.

We also append an illustration of a 25-ton fly wheel, cast in one piece, at the King & Andrews Co.'s foundry. The surroundings show that this was made largely by the use of cores. One-half of the casting is shown as it remains in the mold.

Another Way of Looking at the Melting Ratio.

Of late this subject seems to be attracting quite a bit of attention, and when one notes the wide differences there exists in the quantity of fuel required to melt a given quantity of iron, by as many different foundrymen, one will be inclined to think that some of these men either do not know how to melt iron very well, or else they are not very particular about the way they obtain the figures which they quote as a ratio. The writer believes that the latter will explain the majority of cases where the ratios vary very much from the ordinary. A case I have in mind is that of a large melter of iron who stated that their ratio for a year was about 1 to 5. Before saying so, he explained that considerable of the coke, which had been received by the company, had been used in their core ovens, and stoves employed during the cold weather to heat the foundry. He did not know the exact amount of fuel which had been consumed for these purposes, although it was assumed that this was but a small percentage of the total. At the end of the year all of the coke used was compared with the amount of iron melted and in that way the ratio mentioned above was obtained.

It does not seem quite fair to charge the coke used for other purposes against the melting ratio. I believe variations in the quantity of coke used to melt iron are confined to very narrow limits, and that when this seems otherwise, all conditions are not taken into con-

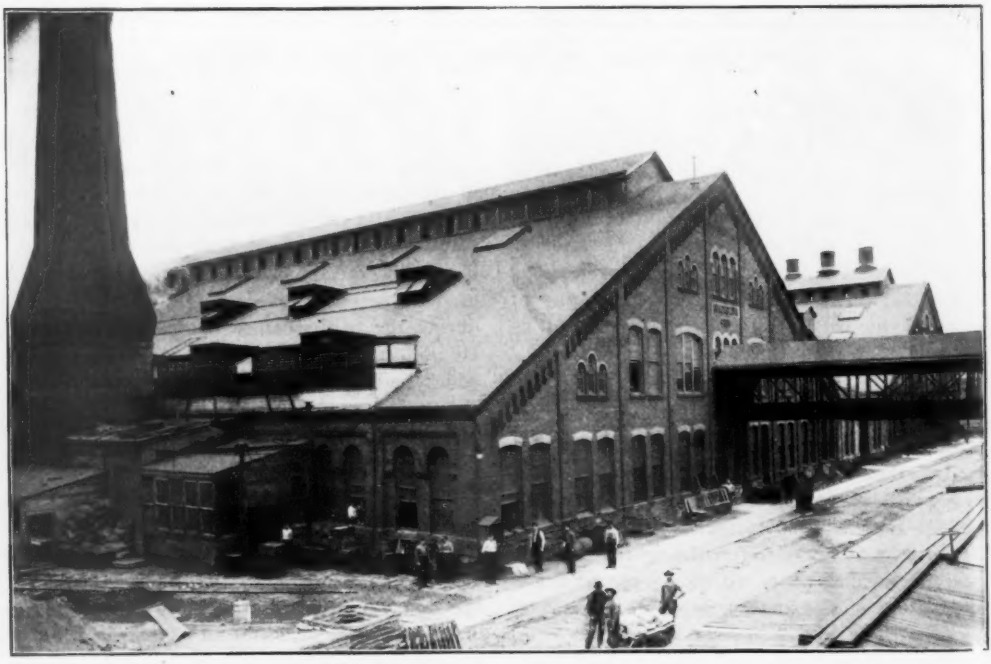
sideration. Let us suppose that we have two cupolas of the same diameter and that one melts a heat of eight charges while twenty charges are melted in the other one. We will assume that both cupolas are charged the same, let us say, 800 pounds of coke and 2,400 pounds of iron on the bed, and 200 pounds of coke and 2,000 pounds of iron for the following charges, which would make a 1 to 3 ratio on the bed, and a 1 to 10 ratio in the charges. The actual melting performed by both cupolas is the same, yet the one in which the longer heat has been melted shows a ratio of nearly 1 to 9, while the cupola with the smaller heat has a ratio of less than 1 to 7½. Looking for nothing but a good melting ratio the smaller of these two heats could have been melted as hot with less fuel in a smaller cupola. The whole question of melting ratios seems to be largely a matter of long or small heats.

G. K. WELLER.

Oil and Gas Furnaces for Melting Brass.

We show with this an illustration of a number of Paxson-Brown furnaces, using oil as a fuel, installed by the J. W. Paxson Co., of Philadelphia, in the brass foundry of the Westinghouse Air Brake Co., at Wilmerding, Pa. This installation comprises twenty-two furnaces, each having a capacity of 500 pounds of molten metal. The furnace is composed of two cast iron shells, lined with fire brick and bolted together. In the upper half of the shell there is an outlet for the escape of waste heat. The lid on the top of the furnace is raised and lowered by a lever, whenever it is removed to permit charging or for other purposes. Eye bolts are provided for lifting the upper shell, whenever it is required to put in a new crucible, or repair the furnace. The trolley system noticed above the furnace is intended to facilitate the handling of any part of the furnaces.

A special crucible is used in connection with these furnaces, of such a shape and size, as allows considerable air space between this and the lining, and also space for the flue connection. As to the life of these crucibles, it is stated that some of these have served for as many as 107 heats each. The furnace is provided with a spout, through which the metal is poured off when in the proper condition; this spout being blocked with sand during the time of melting. Air and oil connections are made to the lower section of the furnace, a blast pressure of from 10 to 20 pounds being required according to the number of furnaces



BRASS FOUNDRY OF THE WESTINGHOUSE AIR BRAKE CO., WILMERDING, PA.

PAXSON-BROWN OIL BURNING FURNACES FOR MELTING BRASS AT THE WESTINGHOUSE AIR BRAKE CO.'S FOUNDRY.

in use. The connections are so made that any furnace may be cut out when its services are not required. The tilting of the furnace is accomplished through a hand wheel, connecting with a worm gear. The lower body of the furnace is provided with a slag hole, which also furnishes the means, by which the molten metal may be withdrawn, should a crucible break during melting or spilling occur from any cause.

At the Westinghouse brass foundry a record of the mixture being melted in each furnace is kept on the back of the numbered dials to be noticed at the rear of the furnaces. The record board to be seen on the wall keeps track of the time the furnaces are started. Spaces are provided on the board for each hour of the day, and pegs are used in conjunction with the holes in such spaces to register the time of melting.

When in operation little or no flame comes in contact with the metal, which accounts for the small loss; this in the case of yellow brass has been found to run about 1.6 per cent. The manufacturers say that from 115 to 125 pounds of metal is melted with a gallon of oil, the time necessary for the melting of a full crucible of metal being one and one-half hours. When gas instead of oil is used as a fuel an air pressure of ¾ oz. furnished by a small fan blower has been found to give an ample supply of air.

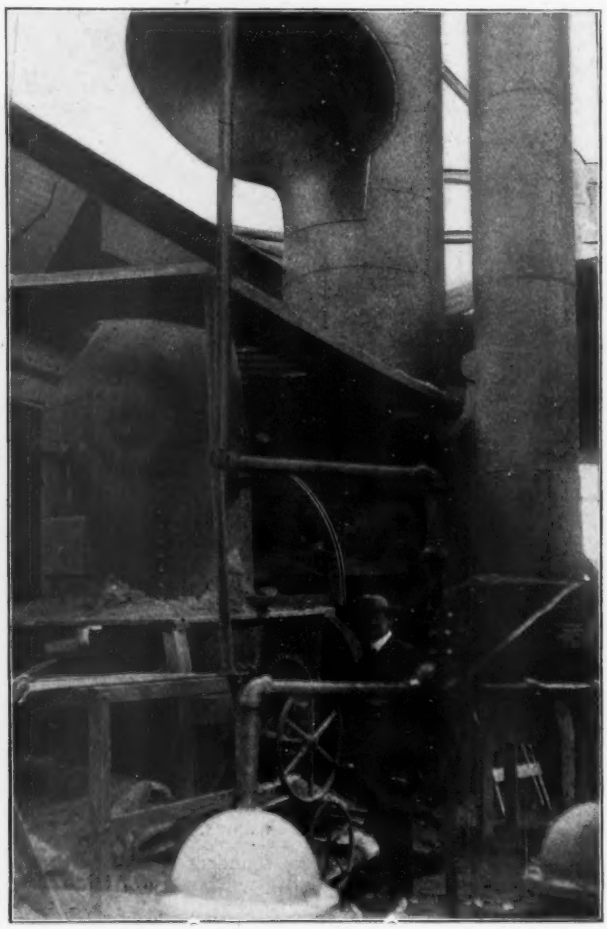
The Wills Method of Producing Steel for Steel Castings.

For several years founders have been awaiting a method by which steel suitable for castings may be produced in reasonable quantities. The ideal metal for this purpose should have a high tensile strength and sufficient ductility to stand bending, welding, riveting and other demands made upon high grade steel castings. The desire of the founder has been to secure a metal at a minimum cost which should be hot and fluid enough to run small work in green sand, as well as heavier castings.

We show with this an illustration of a new converter patented by E. Cooper Wills, as the same appears in the works of the Uniform

Steel Co., Rahway, N. J. Castings are being made in the high grades of tool, machinery and low carbon steels as these are called for. The Wills converter consists of two sections working independent of each other, a dome section, and a converter section which is formed by the ladles used for pouring the metal.

In operation the ladle is placed on a truck, and run under the dome section which in this case is stationary. The metal is run directly



into the ladles from the cupolas through an opening in the dome section. When the ladle is full, this opening is closed and the metal skimmed through the opening left at the lip of the ladle. The tuyeres are placed on the side opposite to the lip of the ladle, connections being made with these through 6-inch pipes. Before blowing begins the openings are closed with sand mixed with a small portion of clay; but little of this is required, as the ladles and dome sections fit together tightly. From two to six pounds pressure of air is supplied.

A special flux is employed which, it is claimed, assists in removing the phosphorus and sulphur to be found in the metal. When the blow has been completed, the ladle is taken away, and another one run underneath the dome. Two or more ladles being employed according to the amount of iron which is being melted. While the first is being poured, the second one is receiving treatment. Where small castings are being manufactured, the metal may be poured into small ladles for distribution to the different floors, no bottom pouring arrangement being necessary.

As shown in the illustration, the hood over the dome section leads directly into the cupola. A movable dome section may also be employed where this is deemed advisable. Among the advantages claimed for this process, is the small room taken up, and the fact that the ladle has as high a temperature as the steel, which is being converted therein, causing the slag to come freely to the surface and giving a cleaner metal. In the first heat made in this converter there was produced a steel having .14 carbon, showing a tensile strength of 80,000 pounds per square inch without annealing. To show that metal produced by the Wills process possesses a high initial temperature, it is stated that it has been held in the ladle for an hour and then poured successfully. It is also stated to be remarkably free from shrinkage cracks and blow holes.

It is intended to manufacture the Wills converter for the trade in the near future and the J. W. Paxson Co., of Philadelphia, have been made general sales agents.

The Herron-Brady Pump & Foundry Co. has been organized at Chattanooga, Tenn., with a capital of $100,000 by Chas. Herron, H. S. Chamberlain, D. P. Montague, R. H. Williams and George D. Lancaster.

Kranks' Korner.

I notice an enterprising supply house offers to furnish founders with approximate analyses of the irons they use upon receipt of the names of the brands. This makes me think of certain people who claim they can foretell your future by taking a good look at a lock of your hair.

The average analysis of an iron is worth little if anything to the general founder. Furnaces are making, and will continue to make a certain percentage of off-grade iron and when a foundryman experiences trouble, the chances are that a small lot of this may have been distributed in a shipment sent him. Under such circumstances an approximate analysis is of no help whatever. When a foundry iron is what it should be the founder jogs along in his innocent way, but when his mixtures are knocked out of kilter he needs definite advice as to where the trouble may be found and remedied. The best way to do this is not to go around looking for someone having a guide book to the chemical characteristics of various brands, instead, the shortest route will be to take some drillings to a chemist for analysis and possibly the dissecting of a chunk of coke may throw further light on the seat of the difficulty.

Before me I have some literature which says that a good mixture for machinery castings is composed of Northern pig, Southern pig and scrap in equal proportions. Perhaps if each of these is what it should be, the casting will be satisfactory. It is not surprising that some foundries should have trouble if they follow such knock-kneed recipes in calculating their mixtures. The same authority also asserts that plumbago is graphitic carbon and that graphitic carbon hardens the metal. Since combined carbon also hardens the iron, what kind of carbon shall the founder have in his iron? Evidently our metallurgists do not know as much as they should about graphitic carbon and its effect upon iron.

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An item has been extensively published to the effect that the Sterling Wrench & Tool Co., of Dixon, Ill., incorporated with a capital of $250,000, was building a foundry for making malleable iron and steel castings; in connection with the operation of which there would be many new and special features. A brick structure (the first building, by the way) 50x150 feet was said to be about ready for the roof and the promoter, a Mr. E. T. Warn, who is claimed to be an experienced mechanic, has introduced the following paragraph in the incorporation papers in order to guard against having more money than he can spend himself: "A scale of wages shall be paid at all times equal to those demanded by union labor and as much more as it is possible to pay consistent with the welfare of the concern, while using due diligence to continue business without cramping the company for funds." The account of this interesting concern continues: "Another feature of this company is the manner of making payments for labor performed. A time check is given each evening to each workman, this check being good at the bank, and a man can cash his time checks at any time he chooses. Mr. Warn has just filed incorporation papers for a company with authorized capital of ten million dollars and expects to build a city on the co-operative plan. This company will be known as the Laborers' Industrial Development Co."

There are a few more details to be added to the above before the information conveyed therein is authentic. The brick structure is not ready for the roof, it is represented by a medium sized hole in the ground. No time checks have been issued, which are good at the bank. It seems as if due diligence has not been used, as the company is cramped for funds. There are no signs as yet of the ten million dollar city. With this alteration the item is correct.

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Some sage advice appertaining to foundry practice in general is given out from time to time in certain quarters. A gentleman is anxious to know how he may pour dull brass without having the castings marred by cold shuts and is told to use a large sprue, pouring quickly and keeping the gate well filled. Perhaps the party would be money ahead by melting his metal properly. Someone wants to learn the pressure of blast in ounces, necessary for different sized cupolas, and is informed that molders differ on this important question, some molders preferring 13 or 14 ounces while others want more or less. It will probably be news to the trade in general to learn that the molders have anything whatever to say about the blast pressure which shall be employed in melting

iron. It is funny what strange discoveries can be made by people who only see a foundry when they pass it on a street car.

* * * * * *

An Ohio concern recently sought to engage a new foreman for its foundry. One of the applicants for this position received the following particulars: "We are paying a foreman at present $2.70 for nine hours and he does all the difficult core work. We are looking for a profitable man who can handle men successfully and turn out good castings."

As this firm makes gas engines and steam pumps the foreman must have quite a number of difficult cores to make. The fact that he done so and looked after the foundry besides for the magnificent salary of $2.70 per day, should have satisfied his employers, but evidently he is not considered profitable enough. This is all the more remarkable when we consider that good jobbing molders are having no difficulty in securing at least $3.00 per day. It is my opinion that this foreman is one of those who has outlived his usefulness by staying too long in one place and the sooner his unappreciative employers kick him out the better it will be for him. He has everything to gain and nothing to lose.

* * * * * *

A Chicago newspaper item states that the boys employed at coremaking in the foundries of that city have declared war upon the practice of engaging girls for the trade, and will ask the iron molders to aid them. The boys declare that the trade is not one in which girls should be engaged. They say that many of them who had been earning $10 a week were displaced by girls at half the wages.

Girls have been employed in making cores for many years, yet very frequently objections are entered against this practice. While I do not believe there is anything specially inviting about the trade to delicate femininity, still I can conceive of a coreroom being kept clean and everything so well in order, that working therein can be preferred to other occupations in which girls engage. If I remember rightly many foundries claim that female coremakers are more efficient than those of the sterner sex. This I believe is directly due to the fact that boys are placed most anywhere and largely left to shift for themselves while girls are provided with better quarters and incidentally receive better supervision. Don't you believe there is something in this?

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That man over in Scotland who used to write about "absolute shrinkage" hasn't been heard from lately. As this is several hundred degrees below zero he has probably concluded that it does not have as much to do with the foundry business as he once thought it had.

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And now comes my friend Mr. Sleeth with the statement that he has had no trouble in making soft castings with coke as high as 1.71 per cent in sulphur, and if he can do this, other foundrymen will likely ask their foremen to explain why they can not do the same. Then the coke makers have been claiming that this fuel should have a high fixed carbon content in order to do the best melting, while Mr. Sleeth found that a light coke gave the same results, bulk for bulk, as a heavier coke. Here is a chance for argument.

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The *American Electrician* has discovered that when it comes to making steel castings the American founder does not amount to much. The yarn this journal spins sounds as follows:

"It is a matter of common knowledge in engineering circles that the buyer of cast steel made in this country has to take what he can get rather than what he actually wants. When a core-box of any degree of intricacy is offered to a steel founder, he throws up his hands in dismay; and if the customer is not too important in the industrial field, the founder intimates that he doesn't care for his—the customer's—business anyhow, if it runs that way. Angles must be filleted to an absurd radius, lugs of a size less than one capable of sustaining a ton or so may "come" on the casting and may not, air pockets or blow holes occur with disconcerting frequency and almost invariably in that section of the casting where they do the most harm. In short, the production of sound steel castings of small bulk and accurate contour appears to be accidental, if it ever occurs at all.

"This is not true in the best European foundries. We have seen French steel castings, for example, that are amazingly true to

pattern, thin-walled and sound, with cored recesses of a character that would doubtless be considered absolutely prohibitive in the United States. We do not know enough of the practical details of steel molding to form any opinion as to the explanation of these facts; they exist, however, unfortunately beyond dispute, and their existence is without apparent justification. It is certainly true that the market here for fine steel castings is sufficiently large and attractive to warrant the most exhaustive experimentation and expensive plant equipment that one can conceive to be necessary for the production of such castings. It is true also that there is no lack of brains and energy in the American metallurgical industry. These two well-known facts are precisely the things that render it impossible to understand why foreign steel castings are so much superior to ours in the particulars mentioned."

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Several hundred thousand tons of steel castings are made in the United States annually, and a portion of this output may not be what it should. There are culls in every field. The question of making fine steel castings is the same as that of making fine castings of any metal, one of cost. The steel founder of this country is interested in securing as large a tonnage as possible from his plant and it is undoubtedly true that he does not care whether he secures "watch case" jobs, unless the customer will pay a high price. Every branch of the foundry trade is acquainted with the curious designs of patterns brought in by people who have no knowledge of founding and undoubtedly some individual of this kind, who did not receive the encouragement he thought himself entitled to at the hands of the steel founders, reported his case to the *Electrician*, which immediately jumped at the conclusion that the making of steel castings is an unknown art here.

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A committee of Britsh workmen, representing a number of trades, recently visited this country with a view of becoming better acquainted with the industrial conditions prevailing here, the molders being represented by Mr. James Maddison, the venerable secretary of the Friendly Society of Iron Founders of England, Ireland and Wales. A relatively short period, far too short to permit the members of the commission to make a thorough investigation of the details connected with our industrial life, was spent in visiting various cities. Naturally labor leaders on this side sought to make the stay of the visitors a pleasant one and judging from the number of tally-ho trips I have seen mentioned in this connection, but little time was left for actual investigation of factory surroundings. This is not saying that the members of the commission did not have a chance to observe some of the ways in which we do things, what I object to is that whenever strangers come here, we drag them off to the best we have in the line of shops and educational institutions, instead of giving them an insight into conditions, which are not what they should be, in short we let them leave us with a wrong idea of the way a great part of our population works and lives. I am doubtful if Mr. Maddison has an accurate conception of how a certain portion of our foundries are operated, as I am certain he only had a chance to obtain a glimpse at the better class of shops.

Indirect Expenses of Foundry Production.

In the making of castings, as in other branches of manufacture, the cost of production is based on three factors—labor, material and indirect expenses. The metal of which similar castings produced by different foundries are composed must to a great extent represent the same cost, and it is equally true that the labor cost of two competing foundries operating in the same locality will be found to vary but little. In that part of the cost of production represented by indirect manufacturing expenses will be found the greatest opportunities for economy, and according as these are the results of economical or wasteful methods the ultimate outcome may be success or failure.

Of the many expenses of this nature entering into the cost of the output of a foundry, perhaps none are of greater moment than those incurred in connection with the making, handling and repairing of patterns. To so record these expenses that the output of the foundry will bear its proper share, but will in no case be charged with any such expenditure which should rightly go against equipment account or against the cost of selling, frequently calls for nice judgment. To so index the contents of a pattern room that the number of

a required pattern can be at once ascertained, and being known, its proper location seen at a glance, and itself instantly procured is no small task when there are anywhere from 5,000 to 25,000 patterns on hand. Not to so index patterns and keep track of the expenses connected with them may have a more direct bearing on the cost of output and affect it to a greater extent than might be thought. It should be remembered that where difficulty is found in procuring any required pattern the time spent looking for it is usually that of foremen of departments, not of workmen; as a result it is time which can least be spared from its proper purposes, and yet it is time the amount of which is least likely to be recognized. Let any large factory or foundry where there is found considerable trouble obtaining the patterns required issue a shop order for "looking for patterns," and charge up against that order all time so spent, whether of foremen or of workmen from the foundry or from the shops, the results shown will in many cases be surprising.

As regards repairs and alterations, these can only be properly distributed by drawing a clear line between them. While repairs and renewals are a legitimate expense of the pattern room, alterations are more frequently an extra expenditure properly chargeable against the cost of selling, not of making. The distinction is greater than would appear on the surface. The expense of altering patterns to suit particular or exceptional requirements is of an entirely different nature from the expense of keeping them in proper repair. Being practically impossible to charge individual castings with the cost of repairing the patterns from whch they are molded, all practical purposes will be served if the gross amount of such expense is distributed on that class of the output to which castings from such patterns belong. Not so, however, with the expense of altering a pattern when incurred for the purpose of meeting a customer's requirements. In such case the outlay is a legitimate selling expense and, if impossible to charge the individual sale with it, it should be distributed on the sales, not on the production. Unless this be done, and if the amount of such expenditures be considerable, the results will be misleading costs of production, and it may appear as though the foundry is turning out castings at a cost which renders it impossible to meet competition, when in reality they are being produced at a perfectly legitimate figure.

In the case of a brass foundry using a large amount of scrap close supervision of the metal room will often point out opportunities for cost reduction. Accurate and reliable figures showing the loss in weight of scrap paid for, and scrap actually used, might be surprising if not alarming. The fact that it is *scrap* seems in some unaccountable way to lessen its value in the eyes of those handlng it, and to make all concerned more careless toward it than regarding new metal of perhaps lesser value. Even such a small matter as the careful recording of the weight of dirt thrown or swept out of the metal room after the smallest particles of metal have been removed may lead to good results. It may be assumed that practically all of said dirt has been paid for at the current market rates of scrap metal, and thus may be shown the need for closer examination of scrap purchased. In many cases the difference between ingot metal at say 13 cents and scrap at 11 cents is very much more than 2 cents per pound.

In the foundry itself the indirect expenses of manufacture are made up of a great number of items, which it is often thought impossible or useless to obtain records of in accurate detail. How many foundrymen know the weight of bad castings made each month, and the proportion such weight bears to the total output? Very frequently the figures supposed to represent this only show the bad castings made during the month and not detected by the workmen before they have left the foundry floor. In how many foundries are all the bad castings charged back to an expense account at the price of similar perfect castings and then credited at scrap value, thus showing from month to month the "dollar and cent loss" from this cause? Many other details, small in themselves, can be recorded and watched to advantage. The supplies used in the core room, the number of heats different makes of crucibles will stand, etc., are points which, though small, may have a direct bearing on the ultimate result.

In the present widespread prosperity, any foundry with modern equipment and capable management should get a share of the trade. When unable to do so, the cost of the output is the first point the executive will want examined. The first steps towards cost reduction must be intelligent and fair discrimination between the costs of manufacturing and selling, and accurate knowledge of the costs of produc-

tion to much greater detail than merely their division into labor, material and shop expenses. The end of cost accounting is cost reduction, and there can be no cost reduction without full knowledge of costs; there can be no full and complete knowledge of costs without careful examination and analysis of the indirect expenses of producing the output.

KENNETH FALCONER.

Montreal, P. Q.

Valuation of Foundry Pig Iron.

At a recent meeting of the New England Foundrymen's Association, Richard Moldenke, secretary of the American Foundrymen's Association, read a paper on this subject. The author referred to a memorial of the same character presented at the Boston meeting of the A. F. A. and stated that he realized very fully that it was a radical step which was certain to be objected to by furnacemen generally. It was done to invite discussion and suggested a possible method of solving a problem which has long faced the foundryman who has to make castings for the severest service. Mr. Moldenke continues:

"It is very obvious that improvement should be made at every stage of the casting process. Then why not improve at the very starting point—the pig iron? We all realize that however we may specialize in our work, the jobbing foundry will always be with us, and no foundry pig iron worthy of the name need be left on the hands of its makers for want of work to cast it into. On the other hand, the founders of specialties, who have helped make this country so great as a manufacturing nation, are entitled to—nay more, should demand—perfection, as near as it can be attained, in their raw material. When they feel reasonably certain that they have the best pig iron obtainable, the best fuel, the most efficient melting processes, molding, pouring and cleaning outfits, then they will think again, and look for further economies and improvements. This is only the modern way of doing business, superinduced by lively competition, and we are truly desirous of co-operating with the furnaces in every way possible to bring about improved results.

"It will be remembered that I proposed the study and subsequent adoption of standard methods of judging the value of pig iron for our purposes. I urged that the chemical standpoint, now so generally accepted, was not sufficient where the highest measure of quality in castings is concerned; that we cannot by chemical means trace the weakening influences of poor blast furnace practice, which may be diluted by judicious mixing with good irons, but which should be detected and the poor material weeded out absolutely for important and special work; that even the most uninformed foundryman today knows that it is useless to test iron in the pig direct, because of the wide variation in strength due to the cross section, pouring temperature, and treatment in the casting house. This, outside of the furnace end of the proposition. It is therefore necessary to remelt this iron and to cast it into sufficient bars to get an idea as to its value for the work required. To do this with fairness and a reasonable chance of success, I recommended the use of a standard cupola, standard coke, standard conditions of charging, blast—in fact, the whole process accurately laid out, and standard test bars, possibly a dozen of them, from which to obtain the knowledge sought.

"The plan proposed for ascertaining the value of foundry iron has brought forth some criticism, which shows the interesting fact that there is a unanimous and settled willingness to sell pig iron by analysis. The work of our well known pioneers in foundry progress has thus revolutionized the old selling methods, for nowhere is fracture mentioned. For this much let us be thankful. No one would have thought this possible in the few years that have passed since grading by fracture was attacked. All the furnacemen on record think that selling pig iron by analysis is sufficient. They do not, however, realize that the roll maker, the founder of car wheels, the maker of malleable castings for specified tests, use several brands of the best irons obtainable, all of the proper composition, for safety; and when, in spite of this and the greatest care everywhere, the rolls crack, the car wheels fail to pass, and the couplers will not stand up, first one brand of iron is cut out and then another, and thus the hitherto unsuspected iron is weeded out. Doubtless this iron might be a very good one generally, but if the foundryman had the means of knowing that his shipments were made while the furnace was under a cloud, he would rather give away the iron than put it into large rolls. Such irons, while showing the right composition, might be so badly burned in the making that normally strong pigs will break in two by simply letting them fall on a rail. The

cupola and the hearth furnaces are not the only places where iron can be badly oxidized, but this is very difficult to trace chemically.

"One of my critics holds that skillful foundry practice overcomes some defects in a pig iron. True, judicious mixing will dilute excessive evils, but the foundryman is not desirous of paying full prices for this privilege. The very thing the method I proposed is intended for—the discovery of undue oxidation—cannot be eradicated by any foundry practice for cast iron we know of now.

"Several critics do me the honor of holding that my proposition is correct theoretically, in fact ideal, if only possible to realize; that no progressive furnaceman has anything to fear from it, while the unprogressive one has, and depends upon a mixture of his with other good irons. It is suggested that enough bars be cast to make certain of a fair showing, and that the lines be not drawn too tight. All thinking foundrymen will heartily endorse this, for they will always give the fairest interpretation to the tests possible under the circumstances—provided they see an honest attempt to deliver the best iron for the composition specified that can be made. I have never yet caused a single car load of iron to be removed from my yards. Whenever the standard was not met the price was revised, and the metal used for work of minor importance.

"As there seems to be some misapprehension regarding the practical working of the physical test in addition to the chemical, it might be interesting to note how this will in all probability come about. The base price of a given iron will always be determined by the supply and demand; that is, ordinary market conditions. The founder who desires to have a guaranteed strength, as per the test proposed, will naturally be expected to pay for it. This the founder of rolls, car wheels, malleables, government work, special machinery and the list of other castings requiring the highest grade of materials will be glad to do. Wherever castings are made upon the strength and quality of which human life depend, there should be no question of price anyhow.

"As the quantity of pig iron bought under such a test, at least for a long time to come, would be limited, there need be no serious interference with the yard arrangements at the furnaces; in fact I venture to prophesy that whenever a furnace has what is thought to be a specially good cast, it will be put to one side, tested, and the salesman armed with the report for selling to an advantage. This is done right along in the chemical sense with irons specially suited for acid steel production. Why not, then, for car wheels?

"It is further held that the physical strength is not enough, but that shrinkage, scrap carrying capacity, clean and sharp surface, and the microstructure of the iron should be arranged for. This I consider entirely too elaborate, and in fact unnecessary so far as we know now. The plain transverse test is all that is necessary to show what is required when taken in connection with the composition. The contraction of an iron when in the standard test bar, is practically a matter of its composition, and that mostly in the constitution of the carbons. With the large standard test bars, adopted by the American Foundrymen's Association, the influence of the pouring temperature and the molding sand is practically eliminated, leaving the question of contraction of much less importance than was formerly thought to be the case. Of course in the absence of chemical data, a contraction test is very essential, but we are a little beyond that point at the present day.

"So far as the scrap carrying capacity of an iron is concerned I have this much to say. This is also a factor of the composition. A high silicon iron will always carry more scrap than one that is low. My experience may differ from that of others, but I have always been able to hold the same percentage of scrap with any brand of iron of my required composition. I have found no difficulty in making castings from scrap alone when enough high silicon was added to get this element right, and enough manganese to cleanse the metal. I was rather astonished when told the other day that my experience in this line was away off, as the broker in question was selling pig iron comparatively low in silicon which was actually carrying 60 to 80 percent of scrap. He was in turn astonished when told that the scrap was carrying his pig iron. But he was laying great stress on graphite in pig iron, and did not think the other things mattered much. All of which shows that there is still room for missionary work in pig iron circles as well as in those of the foundry industry.

"We all remember the time when furnaces refused to sell pig iron by analysis. Then a premium was asked; in one case presented to me it was $2 a ton. Then the furnacemen yielded gracefully, and are now very glad to be rid of the grading disputes. Undoubtedly

more attention is now given at the furnaces to turning out a more uniform product, big, densely graphitic pigs no longer helping out a low silicon cast. The result has been a direct benefit to the foundry trade as well as themselves. And so also will be the further improvement of the iron by increasing the demand for quality. The very earnest desire for a differentiation of the really good irons from the indifferent or really bad ones will not be thwarted by characterizing my proposal as 'fundamentally wrong, unfair, impossible and undesirable;' as 'opening the doors to controversy;' 'only adapted for weak foundrymen,' or asking too much 'because steel men will not do it,' and 'foundrymen are not educated enough to get any benefit from it.' These tests, whether the one I proposed or other better ones, will come when furnacemen are ready to look for customers again, and then evidence of good qualities will be a good argument for sales.

"It is admitted that poor foundry practice, bad fuel, or even variations in the regular routine will bring about variations in results with the best of irons; that the character of the castings made from pig iron depends upon many conditions; but the fundamental idea remains that with good standards and fair conditions, a good iron should show up well in a remelting test. What the actual strength should be will soon be developed by the foundryman most interested; and gradually pig irons, while varying in composition from month to month, or day to day, as they come from the furnace, will not vary as much in corresponding quality as they do now."

Waste, Wilful and Otherwise.

The article in the February issue of THE FOUNDRY dealing with this subject, while perhaps a trifle overdrawn, is nevertheless true in its main points and will serve its purpose in an excellent manner if it will for once call the attention of foundry managers to some of their extraordinary economies. A short time ago I visited a large shop making a specialty of heavy dry sand and loam work where I saw two laborers engaged in wheeling facing sand to two molders, while two others were cutting over black sand. The molders were leveling off the facing to a depth of 8 to 10 inches, a regular course of ramming. The foreman told me by way of a boast that he always filled his flask after the first course of ramming with black sand. He thought that I was playing tag with his knowledge and ability when I told him that I usually rammed up such jobs in black sand altogether, using perhaps a little facing sand around the gates where the flow of iron is greatest. Throughout the shop I found it the prevailing practice to use facing sand in a very reckless manner, and as it was mixed together at the rate of 1 to 12 with flour, and new sand entirely, it was a very expensive mixture. I was informed that they had tried to use about 20 per cent of old sand without success.

Those in charge of this shop also knew their business so thoroughly that they went so far as to make their own mixture of blacking, a thing commendable in itself if one knows how, but for my part I should hate to have a boiler and keep a laborer all day cooking some cheap blacking costing 2 cents a pound when I can buy a far better prepared blacking for 1½ cents. The wages of the laborer added to perhaps 150 pounds of the boiled concoction made, in my opinion, a very dear blacking. On this matter of facings the absurdities of some foundrymen are amusing, and many insist upon using only new sand in their loam, dry sand and core mixtures, and in a few instances, in addition to flour in goodly proportions, sea coal, saw dust and molasses water are mixed with it. In one case which came under my observation, a manager, having a reputation of being an excellent foundryman, used so much of the latter material that it would defy a strong man to drive the prong of a file into the face of a mold made from this mixture of facing sand. It is very seldom that it is necessary to face a dry sand job all over, and as a rule I never allow this to be done and I have never had any trouble through not doing so. Nevertheless, I know that several of my fellow foundrymen would discharge their molders, or at any rate give them a good calling down if they should see a black patch on a mold after the pattern is drawn. I always have more or less trouble with new men on this account as they seem to be afraid to go ahead on a mold without facing, and until I get them used to my way of doing things an apprentice can generally ram up a job in almost half the time required by strangers in the shop. This refers not only to common work but to the very best classes of medium and heavy engine, marine and pump castings.

Cores are also a source of serious waste, as in many foundries the larger sizes of these are made without cinders and of solid core sand.

I never allow regular core sand to be used in large cores other than as a facing; the middle being filled with cinders and common heap sand from the dry sand floors. By being thus made the core is not only cheaper as far as material and labor is concerned, but it is easier to dry and is decidedly a safer and better core. I have seen barrel cores for steam and water cylinders up to 48 inches in diameter made of solid core sand, and that in shops which would feel very much insulted if they were told that they were not working according to the best approved practice.

Ideas do not travel as fast as they are usually supposed to do. They are blocked by some of the old time foundry managers, who are gradually disappearing, some of them so "sot" in their ways that they would not hear of doing anything other than by their own methods; these people are very consequential and stubborn, more particularly if they happen to hold down a good job. All of this would of course not be anybody else's business were it not for the fact that molders and core makers from such foundries, brought up to all sorts of extravagance as to the use of material, come to work in other shops occasionally and commit acts of waste so gross that the foreman or some of his assistants are kept busy watching this class of mechanics.

Nails, rods, bolts and chaplets are wasted in several instances, particularly so in shops that have no store rooms. No foundry should be without a tool room and a place to keep its stock of necessary supplies. A sand heap, particularly dry sand, has an insatiable appetite for the majority of things consumed in the foundry, and judging from the way it consumes these in some shops one would wonder that it is not useless for its intended purpose. It is the duty of the foundry manager to insist on due economy being practiced by the employes, as a good slice of profits may easily be lost through carelessness. By the way, there is also some waste in keeping molds in the oven two or more days and nights until they are thoroughly dry. The idea that a dry sand mold should be dried thoroughly has long ago been abandoned by advanced foundrymen who only give one night in the oven to even the largest molds. A good skin dry is really all that is necessary if a fair quality of open sand be used.

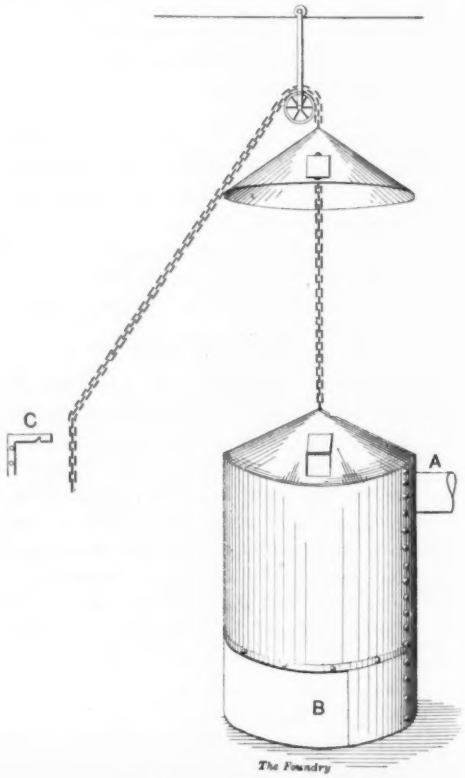
JAS. A. MURPHY.

The Atlas Foundry & Machine Co. succeeds the Atlas Foundry Co. at Tacoma, Wash.

A Home-Made Brass Furnace.

BY MILLARD F. SMITH.

I show with this a sketch of a brass furnace which I think has a good many advantages over the old way of making the body of the furnace even with the top of the floor, especially where the melting room is in the upper part of a building, as the shell of the furnace can be set on one thickness of brick with an inch of sand underneath these and there will not be the least danger of setting the floor on fire. For the furnace shown I use a 40-inch boiler shell for the body, and, by the way, these can be purchased cheap from junk dealers. Cut this to the desired length, making an opening at A for flue to chimney, 5 inches from the top of the shell, then cut out a section at B to facilitate the removal of ashes and cinders; rivet a heavy band or bracket inside of shell to support brick lining and grate bars. I prefer leaving the head of the boiler in as it makes a better base for the furnace to rest upon. I also save the piece cut from the opening at B and rivet strips on each end and a loop in the center for a hand hold, which



A HOME-MADE BRASS FURNACE.

makes this a splendid door through which the draught of the furnace may be perfectly regulated.

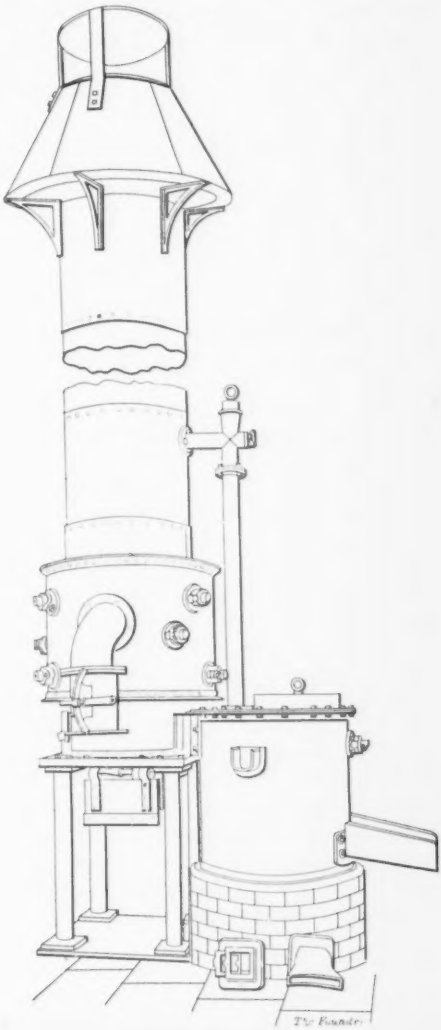
At the side of the furnace I have a platform with two steps which gives the right height for lifting the crucible. In lining the furnace I allow the shell to extend an inch above the brick lining in order to place sand on top of the same, so that the cone cover will fit into the sand and make the furnace practically air tight on top whenever it is necessary to do rapid melting. This cover is made of No. 14 sheet iron and makes one of the best covers that I have ever seen used, it being very light and never gets out of shape. I have used one of these covers for seven years and it is good for five years more. Previous to using a cover of this kind I used cast iron plates which were very heavy and soon cracked and had to be replaced. A counterbalance was also necessary for these heavy covers and they seemed to be out of order most of the time, and always in a position to reflect the heat and making it disagreeable to remove the crucible or to charge the furnace. A sheet iron furnace cover has many advantages, it being very light and easily and quickly removed. I prefer using these as shown in sketch with a light chain and sheave, together with a piece of flat iron turned at the proper angle and notched as at C, which will catch and hold the chain at any link desired. When the cover is drawn up out of the way it will protect the ceiling above the furnace from the heat. One of these covers is easy to make by taking a piece of No. 14 stack iron and cast for it a couple of pieces, leaving space enough in these to pass the chain through. After the pieces are properly cupped and riveted together cut out a piece 2x2½ inches, which is to be again covered with another piece, hinged at its lower edge. Through this opening the metal can be skimmed and viewed without any inconvenience. This cover may not be as new or as good as others that are being used by up-to-date brass foundries, but for cheapness and durability as well as convenience it is considered by all who have visited our shop to be one of the best that have come under their notice.

Grainger & Co., of Louisville, Ky., have increased their capital stock from $100,000 to $200,000 to provide for enlargements.

The International Steam Pump Co. has awarded contracts for the erection of its large plant to be built at Harrison, N. J.

An English Cupola.

British foundries have clung with greater tenacity to the solid bottom style of cupola than American shops, wherein will be found but few cupolas not provided with drop bottoms. It appears to take old melters a long time to learn that a drop bottom cupola is, when properly prepared, as safe as a cupola built with a solid bottom, yet we know such is the case and that the former is gotten ready for melting with considerable less labor and comfort to the melter. The foundries of Great Britain as well as the shops on the Continent also continue to prefer cupolas equipped with reservoirs, whereas these are almost un-



AN ENGLISH CUPOLA.

known here, although mixing ladles, which practically perform the same mission, are very common.

The accompanying illustration shows the "Economic" cupola built by John Barrett, proprietor of the Eastburn Foundry, Cross Hills, near Keighly, England. It is claimed to be a rapid and economical melter and were it not for the reservoir attached to it, it might readily pass for a cupola of special design, such as are found in various parts of this country. While cupola practice on this side has largely reverted to the use of but one row of tuyeres, Barrett's cupola is provided with three rows, the general form of which is shown in the lower part of the illustration. The blast furnished by each row of tuyeres may be regulated through the slides with which they are furnished. The claim is made that when nearing the end of a heat the partial closing of the tuyeres will prolong the life of the lining and avoid chilling the slag, all of which may be true, though it appears to us as if the volume of blast could as readily, if not more so, be regulated by reducing the speed of the fan or blower.

Chilled Cast Iron Car Wheels.*

BY C. H. VANNIER.

Chilled cast iron car wheels are distinctly an American product. In this country they are used under all freight cars and many passenger cars. According to the statistics giving the number of cars in service during the year 1901, there are in round numbers 12,000,000 cast iron car wheels in use under freight and passenger cars. In addition to this, cast iron wheels are used almost exclusively under cars running on street and interurban railways. The total tonnage of cast iron in use in the shape of car wheels now in service approximates 3,500,000 tons, or about one-quarter of the total output of pig iron in the United States in the past year. From these figures one will get an idea of the magnitude of this industry. It has become so important that it is a distinct branch of the foundry business, and to master it thoroughly requires study and experience covering a schooling of many years.

Chilled cast iron car wheels are made from worn-out wheels and new material in the shape of suitable pig iron. To get an idea of the method of manufacture, we will begin in the yard where the iron and old wheels are stored, and we will follow the raw material through the melting furnaces, into the foundry, through the inspection department and into the shipping room, where it appears as the finished wheel.

*A paper read before the students of Purdue University, Lafayette, Ind.

SELECTION OF PIG IRON.

In the most progressive car wheel foundries the pig iron is bought under chemical specifications. When it is received at the foundry each carload is piled separate and marked with the car number, brand and grade. Samples are then taken consisting of 12 pigs representing the average of the carload, and these pigs are drilled and borings mixed, and the borings used for determining the analysis. The analysis of the pig iron consists in determining the silicon, manganese, phosphorus, sulphur and carbon. No analysis is made of old wheels as the average composition of old wheels is already well known. The old wheels before they are put into the melting furnace are broken up and graded according to the fracture and depth of chill. It should be known to the manufacturer what proportions of the different classes of material to mix to get proper mixture to give the results aimed at. This is a matter which can be determined very accurately, if the subject is properly understood.

It is important in selecting pig iron that the proper kinds be chosen. All kinds of pig iron will not answer, for the reason that the chilling property which the mixture must possess is governed by the chemical composition of the material used, especially as to the amount of silicon, manganese, carbon and sulphur.

The limits which must be adhered to in silicon are very narrow, a variation of one-fourth of one per cent being excessive; in fact, with a standard mixture the silicon should not vary between the minimum and maximum limits for an entire day's work more than one-tenth of one per cent, and it is the common practice in properly managed car wheel foundries to run for days at a time with the average silicon in the mixture not having a variation between the minimum and maximum of more than one-tenth of one per cent.

It is not as essential to keep the manganese within as narrow limits, still manganese plays a very important part in car wheel manufacture, and is used to a greater or less extent

by many wheel makers. If used in the proper amount it adds materially to the strength of the wheels.

When the mixture of iron is made up as determined upon by calculation, it is sent to the charging room and thrown into the furnaces, together with coke as fuel. The furnaces generally used for melting car wheel mixtures are cupola furnaces, similar in many respects to those ordinarily used for melting iron for castings, but generally larger.

It is important in making good car wheels to use a good quality of coke. It is especially essential that coke low in sulphur be used, as high sulphur coke will harden iron. Some cupola furnaces used in car wheel manufacture have a melting capacity of 20 tons per hour, running continuously for eight or nine hours.

The melted iron as it comes from the cupola is collected in a large mixing ladle of from three to six tons capacity and from this mixing ladle the iron is poured into ladles having a capacity sufficient to pour one wheel with a little extra iron left over, that is to say, a capacity of about 1,000 pounds of iron.

METHOD OF TESTING CUPOLA METAL.

The character of the metal as it leaves the cupola is judged from test pieces, which are poured from each tap from the cupola. These test pieces usually are 2 x 1½ inches in area and 6 inches long, and are cast with one side against an iron chill block, the other three sides of the mold being made of sand. These test pieces are left in the sand until they are dark red, which means about ten minutes after they are poured. They are then cooled in water and broken in two, so that the fresh fracture will show the depth of chill on test piece. Under ordinary conditions, the chill or depth of white iron, on the test piece, should not be less than 1 inch, nor over 1¼ inches. If the chill is much less than 1 inch there will not be sufficient chill on the wheels which the mixture represents, while if the chill on the test piece exceeds 1¼ inches to any great extent, there will under any ordinary circumstances be too much chill on the wheels.

Any material reduction in the percentage of silicon or manganese, or any material increase in the sulphur, will increase the depth of chill on the test piece; also, any material change in the total carbon in the mixture will have an influence on the depth of chill which the metal throws.

The weight of the standard car wheel used under freight cars is from 550 to 700 pounds, depending on the capacity of the cars, and the standard diameter of freight car wheels is 33 inches.

It is the usual practice for two men to prepare the molds and pour the iron for from 18 to 25 car wheels for a day's work, the molding being done in the forenoon and the pouring of the iron in the afternoon. There are many different systems of delivering the iron to the molding floors. Some foundries use overhead tracks with trolleys, others carry the iron on small trucks which run on floors with iron plates. Then again, there are foundries where the iron is carried in the ladles by cable, the molds being put up in rows.

METHOD OF CHILLING.

A mold for a chilled iron car wheel is made in part of sand and in part of iron. That part of the mold which forms the chilled tread and flange of the wheel is made of iron, while the balance of the mold is made of sand. If the tread and flange of the molds were made of sand also, there would be no chill on that part of the wheel which runs on the rail, because the principle of chilling depends on the rapid absorption of the heat contained in the melted iron, so that when it comes in contact with the iron part of the mold the metal sets almost instantly, and in this way prevents the carbon which is in solution in the melted iron from separating in the graphitic form, resulting in white hard metal. The balance of the wheel poured against the sand mold, on the contrary, cools slowly, giving the carbon an opportunity of separating in part as graphite, and this iron containing a large amount of graphitic carbon, is gray and can be bored, and is at the same time tough and elastic, while the metal forming the tread and which was chilled against the iron part of the mold is dense and very hard, possessing the necessary wearing qualities.

That part of the mold in which the car wheel is made which forms the tread and part of the flange, as already stated, is made of iron. For these iron chills, cast iron is used of good quality, as this part of the mold has to undergo constant expansion and contraction due to the pouring of the molten metal into the mold, followed by the cooling and shrinking away of the casting. The usual thickness of these castings is between three and four inches, the depth being governed by the width of the tread and flange of the wheel. The ordinary depth or height of these chill molds is four inches, making the section 4 x 3½ inches. In time chill molds become fire-cracked where the molten iron comes in con-

tact with the mold, and sometimes the castings burst.

If the tread and flange of the wheel were not chilled, the wheel would give very little service, as the gray iron would wear hollow in a very short time. It must be borne in mind that cast iron car wheels are sold under a guarantee, either as to a certain number of miles, or as to a certain number of years' service. It is, therefore, very important that the wheels shall have a proper chill on the tread and flange. It is customary to guarantee freight car wheels for from four to six years' service, and passenger wheels from 60,000 to 75,000 miles before they are worn out sufficiently to be removed. If the tread of the wheel were not chilled, it would probably not make 1,000 miles before it would be worn to such an extent that it would have to be removed.

MOLDING AND ANNEALING.

It is very essential that the iron be poured into the molds as rapidly as possible. If this is not done, that part of the wheel forming the tread would be imperfect, containing wrinkles and flaws sufficient to warrant the railroad companies in rejecting the wheels. In properly operated wheel foundries wheels weighing 600 pounds are poured in not more than 15 seconds.

After the wheel has been poured, it is left in the sand about 20 minutes. By this time the metal has set in the entire casting. It is then picked up by means of crane tongs, and is conveyed to the annealing pits. These consist of iron cylinders lined with brick with a capacity sufficient to hold from 12 to 20 wheels. A number of these pits are grouped together, and the wheels are left in them from four to six days, so that they may cool slowly. If this were not done and the wheel was allowed to cool quickly, it would not possess any great degree of strength, for the reason that the chilled circumference being much denser than the metal forming the plates and hubs would throw strains on the casting, and in this way weaken it, on the same principle that glass is brittle if cooled suddenly, while it is tough if cooling is done very gradually. The annealing process is one of great importance in the manufacture of car wheels.

After the wheels are taken out of the pits on, let us say, the fifth day after casting, they are passed through cleaning mills where a sand blast is employed and the adhering sand in this way removed. They are then permitted to remain in the inspection room another day to cool when they are taken in hand by the chippers who remove whatever fins there may be on them, and who also remove the sand from between the plates, that is to say, the pan cores.

MEASURING SHRINKAGE—INSPECTION.

The next process is to measure the circumference of each wheel, which is done by means of a steel tape. The object of this is to get at the amount of shrinkage which has taken place in the casting, as compared with the chill mold in which the casting was made. It must be borne in mind that the hardness of cast iron can be determined very closely by determining the shrinkage. There is no better way of determining the hardness of the metal in a car wheel, unless you break it up, than to get the shrinkage, of course, assuming that you know from experience what the shrinkage should be in a good car wheel. Under normal conditions, a 33-inch, 600-pound wheel cast in a standard mold with a chill mold 33½ inches in diameter, will give a wheel exactly 33 inches in diameter, that is to say, the wheel will have shrunk ½ inch in diameter, being that much smaller than the diameter of the chill mold in which it was made. We know from experience that shrinkage much in excess of this means a hard wheel, that is to say, too hard for safety, and we also know that with a shrinkage much less than this we get soft wheels, that is to say, wheels with insufficient chill to warrant their shipment. It will, therefore, be seen that great importance attaches to the measuring of the shrinkage of wheels; in other words, of the taping.

To go on with the inspection: After the wheels have been taped, they are rolled over scales and weighed, at the same time a record being made of the molder who cast the wheel, also of the weight and shrinkage size, and any defects which may show themselves to the inspector who examines each wheel for defects as it passes over the scales. Such wheels as have too much or too little shrinkage are rejected by the inspector, while the good wheels are passed by him and put in stock, subject to result of tests.

TESTING FINISHED WHEELS.

From each day's work wheels are then selected for test. There are two methods of test in use; the one most commonly used is the drop test. For this test, the wheel is laid flange downward in a cast iron block with three supports in such a way that the hub of the wheel is clear from the block. A weight

weighing 140 pounds is then allowed to fall 12 feet, striking the hub of the wheel centrally. Standard 33-inch wheels must stand from 10 to 12 blows under this test without breaking in two or more pieces. Ordinarily, wheels stand a much greater number of blows than this, 10 blows being the minimum under which wheels are accepted. After the test wheels are broken in this way, the depth of chill, which is white, hard iron, in the tread and flange is measured and record made of same. There are set limits for depth of chill. If the wheels have more chill than the maximum limit, the wheels of which the test wheel was representative are scrapped. The maximum limit permissible in the middle of the tread is one inch. The remainder of the iron in the body of the wheel must be gray and strong. If the chill on the test wheel on the other hand is less than one-fourth inch, the wheels of which the test wheel is representative are also scrapped because they have insufficient chill and would not give sufficient service.

In addition to the selection of test wheels from the shrinkage sizes, the test pieces are also consulted, and test wheels are selected from the cupola taps showing the highest chill on the test pieces, as well as wheels from highest shrinkage, so that the two guides used in selecting the test wheels are, on the one hand, the shrinkage size, and on the other, the test pieces taken from each cupola tap. The wheels are stamped when poured, so that the taps from which they came can be identified, and in this way there is no trouble in knowing where to locate a wheel as to which part of the heat it was poured from. In addition to the drop test referred to, there is another test called the thermal test which has come into use within the last five years, the object of this test being to determine on the ability of the wheel to stand expansion when the tread is heated by the brake shoe when the brakes are applied to stop the train or retard its speed. This thermal test consists in pouring a band of molten iron around the tread of the wheel to a depth of four inches, and varies in width from 1⅛ to 1½ inches. In this way the outside of the wheel is heated very rapidly, resulting in a sudden expansion strain being thrown on the wheel which sometimes results in a rupture, the cohesion of the particles of metal not being great enough to stand the expansion force produced by the sudden heating of the tread of the wheel. The specifications made by railroad companies as to what a wheel shall stand under the thermal test are not all alike, some roads requiring that the wheels shall not break through the tread inside of two minutes after the ring of molten metal is poured around the tread of the wheel, others providing for a smaller ring of metal and requiring the wheel not to crack at all through the tread.

HISTORY OF CAR WHEEL MANUFACTURE.

A short history of the cast iron wheel is not without interest. The first cast iron wheel of which I can find any record was made in the year 1800, and was used under small tram cars in Wales. These wheels were without flanges and were very similar in pattern to the ordinary wagon wheel. They ran on rails shaped like angle irons, the flanges being on the outside of the rails. They were made out of ordinary gray iron without any chill. It was not until nearly 50 years after this that they began making wheels with chilled treads and flanges. Among the first to make wheels of this character were Bush & Lobdell, of Wilmington, Del., and Whitney & Sons, of Philadelphia. One will find some very interesting exhibits of car wheels used under cars when railways were first introduced in this country, in the Field Museum at Chicago.

Great improvements have been made in the manufacture of cast iron car wheels since the middle of the last century. The greatest improvements, however, have been made within the last 15 years. The life of a cast iron car wheel measured in mileage has been doubled in the past 15 years, that is to say, the wheels which are turned out now are guaranteed for six years, while those turned out 15 or 20 years ago were not guaranteed for more than three years. In the same way in the mileage, we guarantee wheels today for 75,000 miles, while 40,000 miles was considered a high mileage guarantee 15 years ago.

IMPROVED IN QUALITY.

The severity of the tests required today by railroads for cast iron car wheels could not have been met 15 years ago. At that time five blows were usually specified for the drop test, and there was no such thing as a thermal test. Fifteen years ago the wheelmakers were almost without exception making their mixtures without the aid of chemistry, while today chemistry is one of the important factors in the manufacture of car wheels. In addition to this, much has been done in the last ten years in the way of scientific research, and also by taking advantage of physical tests to an extent which would hardly be credited by

those not familiar with what is going on. As a result, the quality of the cast iron wheel has been greatly improved within the last few years, and this was necessary for the reason that the service required of car wheels at the present day is much more severe than it used to be, owing to the very great increase in the carrying capacity of cars. Twenty years ago a car of 40,000 pounds' carrying capacity was considered something unusual, the ordinary capacity of cars being 28,000 to 30,000 pounds. Today a great many cars are being built with carrying capacity of from 80,000 to 100,000 pounds, and the speed of trains has also been very much increased in the past few years, as compared with the practice of 15 or 20 years ago.

The increase in capacity as between the 24,000-pound capacity cars on the one hand and the 100,000-pound capacity cars on the other hand amounts to 333⅓ per cent. The increase in the area of the axles at the wheel seat as compared between the axles used under 24,000-pound capacity cars and 100,000-pound capacity cars amounts to 175 per cent. The increase in the weight of rails used when 24,000-pound capacity cars were in service, as compared with the standard rail used today amounts to 100 per cent. The guarantee of wheels as between that given 15 years ago and that given today has increased 100 per cent, while the increase in the weight of wheels used under 24,000-pound capacity cars and those under 100,000-pound capacity cars has amounted to about 25 per cent.

TENDENCY TOWARD HEAVIER WHEELS.

The number of wheels per car, which is eight, being the same under a 50-ton car as under a 12-ton car, and the increase in load being 333⅓ per cent, and the increase in guarantee being 100 per cent, there is a demand for increased efficiency in cast iron car wheels of 433⅓ per cent. If the added tare weight of the 50-ton car over the 12-ton car is considered, it can be reasonably estimated that there is a demand for a 500 per cent increase in the service of car wheels today over the service demand which existed not over 15 or 20 years ago. It is only natural for anyone to ask why the weights of the wheels have not been increased in proportion to the weights of the other equipment, such as rails and axles. One answer which I can make to this question is that the cast iron wheel has been giving such satisfactory service under the old style of equipment that it was thought that it was sufficiently strong to carry over twice, and sometimes three times the load which it has been carrying. This, however, has been found to be wrong, and the tendency of the times is towards a heavier wheel for heavy capacity cars, and it looks very much as though a 700-pound, 33-inch wheel would be considered standard for cars of from 80,000 to 100,000-pounds carrying capacity.

Another reason why the railroads have been slow in sanctioning any material increase in the weight of standard car wheels is due to the fact that they do not see their way clear for an increase in the thickness of the flange of the wheel. This is due to the fact that the clearance left between the inside of the track rails and the guard rails, and also the clearance between the points of the frogs and the wing rails of the frogs are of such standard dimensions that any material increase in the thickness of the flange would not permit it to pass through between the guard rail and the track rail, and for this reason we do not see our way clear for any material thickening of the flange until the railroads change their standards for frogs and other special work in their tracks, so that a thicker flange than the present standard may pass through without striking an obstruction. The standard clearance between the inside of the rail and guard rail is 1¾ inches, while the mean thickness of the flange on the wheel is 1⅜ inches.

SEVERE SERVICE REQUIRED.

The requirements which a car wheel has to meet in service today are such that every care must be taken to turn out the very best product. When it is borne in mind that the car wheel is the only part of the equipment of the railroad which is itself in motion, except the axle, and when we bear in mind that it is the wheel that transmits the load from the axle to the rail, and when we consider that the wheels at the same time that they are carrying the load are a good deal of the time in motion, sometimes making 500 revolutions a minute, while running over tracks which are not always in the best condition, and while striking frogs, crossings and switches, we get a fair idea of what is required of a car wheel. However, the car wheel has not only to carry the load at a high rate of speed, but it also furnishes the agency through the brakes for stopping the train. Few people realize the severity of the work required in stopping a train of heavily loaded cars when running at a speed of 40 miles an hour by

means of the friction of the brakes on the wheels. This work generates an enormous amount of heat, which is absorbed by the wheels and results in their expansion. This expansion strain is so great as sometimes to cause a breakage of the wheel; consequently, the manufacturer must provide a sufficient factor of safety so that the wheels will stand this expansion strain without causing breakage. There is probably no other part of vehicles used in transportation that goes through the wear and tear required of a car wheel. They frequently carry a load approximating 15 tons per pair of wheels, and this load is a good deal of the time in rapid motion, and while the wheels are in rapid motion carrying this load the brakes are applied and the wheels heated at times to such an extent that the oil from the journal boxes will ignite on the surface of the wheel, and while in this condition they are sometimes required to pass through snowbanks, resulting in a sudden cooling and contraction, which is a very severe test of the tensile strength of the wheel. It will be seen that the car wheel must have a maximum amount of strength with a minimum amount of weight, and this has been the hard nut for the wheel maker to crack. How well we have succeeded is borne out by the fact that the consumption of cast iron wheels is continually on the increase, and at the same time the quality of the wheel is being improved from year to year.

In mounting wheels of the same nominal weights and diameters on axles, wheels of the same shrinkage size are chosen as pairs for the same axle, so that there may be no material difference in the diameter of the two wheels on the same axle. If this precaution were not taken, and if one wheel on an axle were smaller than the other, the smaller wheel would have to slip more or less on the track to keep up with the other wheel, and this slipping would cause the wheel to wear out sooner than it would if it were properly mated with the other wheel. Mis-mating of wheels also results in the wheels not running true with the track, which results in one of the wheels running against the flange, and soon making what is called a sharp flange or thin flange.

Standard railroad wheels are pressed on axles at a pressure ranging from 30 to 60 tons, the diameter of the bore where the wheel fits on the axle varying from 4 to 6⅞ inches, according to the size of the axle and the carrying capacity of the cars.

CLAIMS FOR THE CAST IRON WHEEL.

Some of the reasons why the cast iron wheel is so popular are the following: In the first place, it is strong and gives a great deal of service. In the second place, it can be manufactured on short notice, and orders for cast iron wheels can be filled in an emergency in from a week to ten days after the receipt of the order. In the third place, cast iron wheels are cheap compared with the other types of wheels. In the fourth place, the worn-out cast iron wheels can always be disposed of at a profitable figure, the market for old wheels being as staple as the market for the best brands of pig iron; in fact, it frequently has occurred that old cast iron car wheels sell for a higher price than standard brands of pig iron.

The largest cast iron car wheel manufacturer is the Griffin Wheel Co., with headquarters at Chicago, and with foundries at Chicago, Detroit, St. Paul, Denver, Kansas City and Tacoma. The output of finished car wheels during the year 1901 by this company amounted to 600,000 wheels. The Griffin Wheel Co. was organized in 1886 with a foundry located at Chicago, and with a capacity for 100 wheels a day, or 30,000 wheels per year. It is now turning out 2,500 wheels a day, melting 500 net tons of iron per day at Chicago plant, and 900 net tons a day at all plants.

Among the Foundries.

Millard F. Smith, of Parsons, Kansas, will extend his present works by an addition 40x55 feet, in which will be installed a cupola, light crane and equipment for making sash weights and other light castings.

The Litchfield Mfg. Co., of Webster City, Iowa, has decided to remove its plant to Waterloo, Iowa, during the coming summer.

The United States Foundry Co. has been organized at Marietta, O., with a capital of $15,000 by W. H. Jett, W. S. Dye, S. H. Plumer, B. A. Plumer and A. T. Williamson.

The Pittsburg Brass Mfg. Co., Pittsburg, Pa., will erect a new factory building, and provisions have been made for a brass foundry to be operated in connection therewith.

The Southern Car & Foundry Co. has leased the plant of the Hercules Iron & Supply Co., Anniston, Ala., and placed it in operation.

John R. Saylor, of Pottstown, Pa., will operate a foundry in connection with his present machine shop.

Michael Burns & Son recently placed a well equipped foundry in operation in Kansas City, Mo. The firm was formerly located in Leavenworth, Kansas, its plant at that point having been destroyed by fire.

The Twin City Iron Works, of Hurley, Wis., will remove its plant to Ironwood, Mich.

The Black & Clawson Co., of Hamilton, O., has been reorganized under the name of the Black-Clawson Co., with a capital of $1,000,000. The plant will be enlarged and a modern foundry erected.

The National Injector Co. recently removed its plant from Cleveland to Geneva, O., where it has purchased the plant of the Knapp & Pratt Mfg. Co.

The Railway Supply Foundry Co., whose plant recently burned at Harvey, Ill., will locate at Chicago Heights, Ill., where a foundry 150x350 feet and other factory buildings will at once be constructed.

The Hudson River Foundry Co. has been incorporated at Poughkeepsie, N. Y., with a capital of $30,000, and will take over the plant heretofore operated by Sague & Thompson.

The Little Giant Hose, Bridge & Gray Iron Co. has been organized at Dennison, O.

The Keystone Hardware Co., of Reading, Pa., has purchased the plant of Rick Bros., which will be used in the manufacture of hardware specialties.

The Kansas City Brass Works, Kansas City, Mo., was recently organized by Wm. Clow & Sons. A specialty will be made of brass, bronze and aluminum castings.

I. J. Merrill has purchased the foundry at Lewistown, Idaho, formerly owned by T. B. Cooper.

Grundy Bros. & Co. are removing their foundry from Kincardine to Strathroy, Ont.

The C. A. Lawton Co., of De Pere, Wis., is building a modern foundry, 80x120 feet in size.

The Maplebay Wind Stacker Co., of Crookston, Minn., has added a foundry to its plant.

The Standard Ideal Sanitary Co. is building a large plant at Port Hope, Ont., for the manufacture of bath tubs, soil pipe and fittings, etc. The officers of the company are: H. T. Bush, president and manager; S. A. Sloman, vice-president; J. R. Sprankle, Jr., secretary and treasurer; A. E. Pipher, superintendent.

The Russel Wheel & Foundry Co., of Detroit, Mich., has increased its capital stock from $275,000 to $350,000.

The Fort Wayne Foundry & Machine Co. is preparing to enlarge its Chicago plant with a view of engaging in the manufacture of car wheels.

The Rat Portage Iron Works, Rat Portage, Ont., will build a modern plant to cost about $12,000.

Plans are being prepared for a foundry building, 90x225 feet, for the Ajax Metal Co., of Philadelphia.

The Akron Brass Co., of Akron, Ohio, will continue the manufacture of brass specialties formerly carried on by the A. L. Lambert Co., of Cleveland. Mr. Lambert will act in the capacity of general manager.

The J. B. & J. M. Cornell Co. has been incorporated and succeeds the firm of J. B. & J. M. Cornell, with works at Cold Spring, N. Y., and New York City.

The Crestline Mfg. Co., Crestline, O., has been organized with a capital of $50,000. G. A. Musselman is president of the new concern; Jacob Flowers, vice-president; Jacob Babst, treasurer, and C. E. Stetter, secretary and general manager. The company will build a modern foundry and machine shop for the manufacture of pumps, steam fittings and general supplies.

Plans have been completed for the Whitney Car Wheel Co.'s plant at Camden, N. J. These provide, among other buildings, for a foundry 98x176 feet, machine and pattern shop 50x85 feet, and a laboratory 40x40 feet. The plant is to have modern equipment throughout and will cost in the neighborhood of $100,000.

The Gohmann Bros. & Kahler Co. of New Albany, Ind., has been formed with the intention of engaging in the manufacture of stoves and hollow-ware.

Fires.

The foundry of Thos. Carlin's Sons' Co. at Allegheny, Pa., together with a number of valuable patterns, was destroyed by fire Feb. 18.

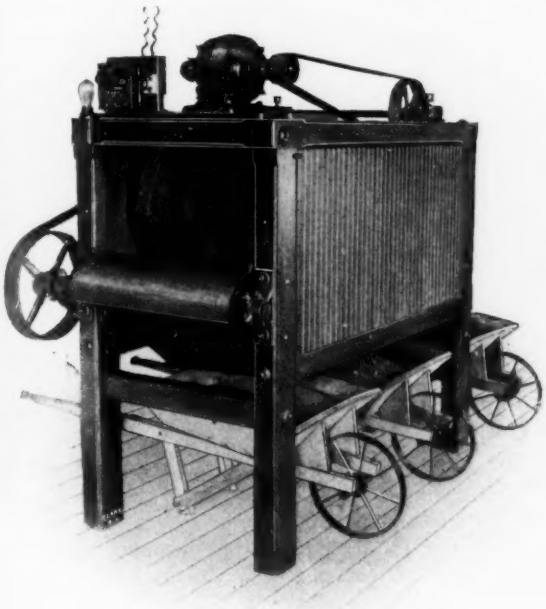
The foundry of the Michigan Wheelbarrow & Truck Co. at Saginaw, Mich., burned Feb. 19.

The malleable and gray iron foundries of the Southern Car & Foundry Co., at Anniston, Ala., burned Feb. 21, causing a loss estimated at $20,000.

The Holbrook-Armstrong Iron Co.'s foundry at Racine, Wis., was badly damaged by a recent fire.

The Dings Improved Magnetic Separator.

The prevailing high price of iron has greatly stimulated interest in devices intended to recover a part of this metal which formerly was wasted. We show with this an illustration of a magnetic separator manufactured by the Dings Electro-Magnetic Separator Co., of Milwaukee, Wis. Among the advantages claimed for this machine is that it makes three separations, viz., sand, coke and iron. While low enough to permit of conveniently shoveling



DINGS IMPROVED MAGNETIC SEPARATOR.

the material into the separator, it is, at the same time, high enough from the floor so as to allow wheelbarrows to be placed in position to receive the different materials, and thus avoid extra handling. The sand may be returned to the foundry to be used for various purposes, and the coke and slag recovered will be found of use in the core department for venting large cores; while the iron is returned to the cupola scaffold to be remelted. When a separator is employed for recovering the iron, the cinder mills may be used with much larger openings than is common, and the cinder can be handled much more rapidly without incurring any loss of iron.

The Dings separator is usually provided with an independent motor which permits of readily shifting the machine from one location to another. The main electrical circuit is not broken in operation and there is consequently no heavy flashing to destroy switching connections. Every magnet is successively discharged as it reaches the high point on the drum, the iron being delivered in a steady stream from an inclined chute, free from dust and ready to be placed in a cupola. The power required to operate the machine is less than ¾ horsepower. Besides building separators for recovering iron, the Dings Electro-Magnetic Separator Co. also make magnetic separators for brass foundries, as well as for other special purposes.

Deaths.

Chas. M. Day, general superintendent of the Draper Co., Hopedale, Mass., died suddenly February 21st, at the age of 43.

Joseph C. Jones, proprietor of the Emporia Foundry & Machine Works, died recently at his home in Emporia, Kan., aged 52 years. He was born in England, and moved in 1872 to Emporia, where he amassed a fortune in the foundry business.

William R. Trigg founder of the Richmond Locomotive Works and more recently the William R. Trigg Shipbuilding Co., died Feb. 16th, at the age of 54 at his home in Richmond, Va.

William J. Taylor, of the Taylor Iron & Steel Co., High Bridge, N. J., died recently at Bound Brook, N. J. He was 67 years old.

Chas. H. Presbrey, of Sterling, Ill., died recently. He was born at Taunton, Mass., March 29, 1835, and took a position as foreman in the Novelty Iron Works at Sterling in 1869. He continued in this position until the early 80's, when he, with Edward Thomas, bought the concern and operated it under the firm name of the Novelty Iron Works for a number of years. Of late the firm name has been Charles H. Presbrey & Co., Mr. Thomas having retained his interests in it until his death.

John Philbrick Laflin, who for a number of years was president of the East Chicago Foundry Co., died Feb. 24th at Miami, Fla., aged 45 years.

Augustus G. Wood, who was prominently connected with the foundry industry of Cam-

den, N. J., for many years, died in that city recently at the age of 67.

Otis T. Stantal, who for 11 years has been superintendent of the Illinois Malleable Iron Co., Chicago, died on March 7. Previous to his connection with the Illinois Malleable Iron Co. he had been employed as head chemist by the Deering Harvester Co., the Crane Co. and the Illinois Steel Co.

Personal.

George Batten, for the past three years foreman of Reeves & Co.'s foundry at Columbus, Ind., has retired and is succeeded by Perry Wooden. Mr. Batten will be connected with a new foundry to be started at that point.

H. W. Cramer has been appointed foreman of the foundry of Wm. Adams & Co., Philadelphia.

C. Bewley will have charge of the new works to be built by the Oregon Foundry & Mach. Co., Oregon, Ill.

Fred Brent has assumed charge of the foundry department of the Portsmouth Foundry & Machine Works, Portsmouth, O.

S. E. Winslow has resigned as foreman of the Hancock Inspirator Co.'s brass foundry, Boston, Mass., to accept a similar position with the Nathan Mfg. Co., New York City. He is succeeded in the former place by Robert Newell.

J. E. Slight has been appointed superintendent of the foundry of the Sheffield Car Co., Three Rivers, Mich. For the last twelve years Mr. Slight has been with the American Locomotive Co., Schenectady, N. Y.

Rigs as a Factor in Foundry Management.

It is surprising how little attention is given by the management of the majority of foundries to rigs for molding. By these I mean patterns made of proper material and placed in the best of condition for molding, flasks that will require only a minimum amount of sand and ramming, properly barred, so that they will not only lift the sand, but also hold it in place and resist the pressure of the metal when the mold is poured. Cranes and other devices for lifting copes, handling weights, molten metal, etc., are also to be classed under the heading of rigs.

In many cases we find patterns made of wood when they should be made of metal, again these are not properly divided or drafted so that they will mold to the best advantage. Sand is lifted in copes that should be left in the drag, and large flasks are required, when small ones could be used, had the pattern been made right; the result being that a great deal more time and labor is consumed than there should be. Very often we find that patterns have not sufficient draft to leave the sand freely, or they are rough and not provided with proper plates for rapping or drawing. The molder removes the pattern from the sand the best way he can and after he has done so a dozen times it is a wreck and double the time is required to finish a mold, than would be the case if the pattern had been made properly and fitted up right in the first place.

It is a common occurrence to find flasks being employed which are entirely too large for the pattern and not of the proper shape, or barred, as they should be. This causes a great deal more sand to be handled and rammed than is necessary, numerous gaggers and soldiers have to be placed in the cope in order to obtain a lift, and when the mold is poured, the casting may be strained on account of weak bars. In many places heavy copes are handled by molders and helpers, who stand around more or less waiting for one another, and a great deal of time is thereby lost, which could be saved by providing a suitable rigging for handling the molds.

To show the advantage of proper rigging, I will cite the case of a foundry which took a contract to make yokes, a plain rough casting for underground trolley conduits, at 2 cents per pound. It lost money on the contract and gave it up, when another founder accepted the same job at 1½ cents per pound and made money at this figure. These two foundries were about the same size and had the same facilities for turning out these castings, the difference being that one provided a rigging, while the other did not.

In the first foundry the castings were molded in any old flask which happened to be on hand large enough to take in the pattern. The molds were handled by hand, and of course many of the flasks were entirely too large and required twice the time to ram up and secure that they should have done. Iron had to be carried a long distance by hand, and the molder after working very hard all day only turned out a limited number of castings. At the foundry which accepted the contract at the lower price, the management designed and constructed a neat iron flask, properly barred, with not one

inch more sand room around the pattern than was actually necessary. A small traveling crane was put up for handling the molds and iron, and no time was spent in doing anything not absolutely necessary. The result was that a molder could turn out three times the amount of castings he could in the first named shop with less labor. The rigging was paid for out of the profits on the contract and after this was completed, the flasks were broken up and everything cleaned up.

At another foundry a small spiral cylinder for a lawn mower was cast in a three part flask, and ten of them was a good day's work. This job was changed to another shop where a special snap flask was designed for molding it, with a neat wire screen netting for clamping the molds, and a molder with this rigging, which by the way cost a great deal less than that employed by the other foundry, turned out 30 cylinders for a day's work. In a certain foundry two grate bars weighing about 150 pounds each were cast in a flask and four of these molds constituted a fair day's work. A new foreman conceived the idea of making these castings one in a flask, which he had made of the proper size, when the same molder put up twelve castings for a day's work and did not labor as hard as he did when he put up eight. How long did it take the extra bars turned out by this molder to pay for the new flasks?

Entirely too little attention is given to special rigs by the majority of foundrymen. They appear to think that every cent paid out for these is a useless expense which only add to the cost of castings. Whether there is one piece to be made from a pattern or a thousand, anything to be found in the flask yard or about the shop is considered sufficient equipment for filling any contract that comes along. While we all recognize that this theory may work well where only one or two castings are wanted from a pattern, yet, it is not always economy to avoid getting up riggings for such jobs, as we often know that a casting may under such circumstances be lost, not only once but several times, for want of proper rigging. Without facilities higher priced molders are required, and the output per man is limited.

Taking it for granted that where only a limited number of castings are to be made the founder cannot afford to get up any very expensive riggings, the fact, nevertheless, remains that a flask should be properly barred up and this is something which the molder should not be asked to do, as the shop carpenter can do a much better job. When this work is left to the molder, the latter generally simply cuts away the bars, so that they do not touch the pattern, when he must depend upon gaggers and soldiers to insure a lift. While these are useful they are a poor substitute for proper bars in a flask, and many a mold has to be rammed up again or a casting is lost just because the attempt has been made to do without the carpenter's services.

Patterns should be made of wood or metal as is most suitable and of course they should be so designed and finished as to require but a minimum amount of time in molding. Even on relatively small orders it will pay to follow board a pattern as this is soon paid for in the time saved in making partings. Where iron flasks are used it will generally be found much more profitable to break these up when an order has been completed rather than to have them laying around waiting for a job to come along which they may fit. It is only by providing suitable shop riggings that the stove, pipe, radiator and other specialty foundries are able to turn out castings cheaply and fill their orders. Were it not for the improved facilities in these foundries the output would not be half of what it is. In the same way one jobbing foundry is able to underbid another just according to the ability it shows in devising special rigs. It would pay many of our foundries to provide a man of an inventive turn of mind as a rig foreman, whose duty it should be to look into every order for castings and note what could be done to save labor and time in filling it. This man need necessarily not be a molder, for in many cases this kind of work has to be done by flask carpenters, who are frequently better designers of rigs than the foundry foreman. In many shops no inducement whatever is offered for molders to design rigs for rapid molding, instead a premium is offered them for not doing so; for they know from past experience, when working by the piece that if they in any way are able to double the number of molds they can put up, the price will be cut so that in the end they will not be able to earn any more money per day, while if they are working by the day, their wages will not be increased. Such should not be the case; for if there is a profit for the founder in a day's work at a certain figure, there should be double the profit at the same price, if a molder doubles his out-

put of castings, and there is no reason why the molder should not receive double pay for the interest he has taken in his work. It is very seldom founders take this view of it, instead they want all the financial advantages to go into their own pocket. It is a fact that I have known of but few foundrymen who made it a practice to reward their molders for good ideas. However, I have noticed that when this is done such shops generally have good molders, and plenty of work for them to do.

EDWARD KIRK.

Notes from Various Sources.

The Ravena Iron Co., Ravena, N. Y., recently incorporated with a capital stock of $25,000, will manufacture steam and hot water fittings, flange unions, castings, etc.

The J. S. McCormick Co., of Pittsburg, manufacturers of and dealers in foundry equipments and supplies, have increased their capital stock from $50,000 to $150,000. The company is operating a plant at Mauch Chunk and one in Pittsburg and has doubled the capacity of both the past year. J. S. McCormick is president and T. E. Malone secretary and treasurer.

The Syracuse Heater Co., Syracuse, N. Y., has purchased a site in the suburb of De Witt, upon which a new plant will be constructed. The first building to be erected will be a foundry, 100 feet square, so arranged that additions can be made at any time. Other buildings will be provided for the assembling and mounting of castings and for storing goods and material. Charles D. Howard is president.

A revised edition of Edward Kirk's "Cupola Furnace" has just been issued. About 200 pages of new matter relating to cupolas, fuels, foundry irons and chemistry have been added, which makes the book one of the most interesting ever placed before foundrymen.

James Bonar & Co., of Pittsburg, Pa., manufacturers of steam appliances, are constructing a machine shop and brass foundry of which Colin McInnes will have charge as superintendent.

Kenneth Falconer, 34 Staynor avenue, Westmount, Montreal, Canada, is making a specialty of designing systems for ascertaining the cost of production or any item connected with factory accounting.

T. McAvity & Sons, St. John, N. B., Canada, are building an addition to their brass foundry.

"Analyses of Pig Iron," volume 2, has just been issued by S. R. Church, of San Francisco. This contains entirely different matter from volume 1, both taken together constituting the most complete compilation of analyses and characteristics of pig irons throughout the world. The price of each volume is $5.00.

The Westinghouse Air Brake Co. will erect an additional foundry at Wilmerding, Pa., 60x320 feet, for casting patented car buffers.

The 1903 convention of the American Foundrymen's Association will be held in Milwaukee, Wis., June 9-10-11. Those desiring to offer topics for discussion should address the secretary, Dr. Richard Moldenke, Box 432, New York City.

The Core Makers' Union has voted in favor of amalgamating its interests with those of the Iron Molders' Union.

Under the name of the American Seeding Machine Co., a consolidation has been effected among builders of seeding machinery, including the following firms: Superior Drill Co., Springfield, O.; Hoosier Drill Co., Richmond, Ind.; Empire Drill Co., Shortsville, N. Y.; Brennan & Co., Louisville, Ky.; Dowagiac Mfg. Co., Dowagiac, Mich.; P. P. Mast & Co., Springfield, O., and Bickford & Huffman Co., Macedon, N. Y. The capital stock is $15,000,000.

Remedy for Defective Crank Pin Bearings.

In the January number of THE FOUNDRY David Rogers asks for information in regard to the successful molding of brass crank pin bearings. I would suggest that said castings be poured on end. These bearings could be molded in the ordinary way, by simply cutting a circular hole in one end of flask, at the joint, for the gate pin to protrude. After the drag has been rolled over, bed in a round gate pin along side of pattern, and before closing flask, cut a gate from mold to gate pin at a point that will cause metal to enter mold at the lowest level when flask is stood on end for pouring. Use an extra bottom board for cope, when clamping together, to prevent the sand bulging from between bars of cope while the mold is being poured. If this plan is adopted the trouble referred to will undoubtedly disappear; for if any defects do present themselves, they will be located in such a part of the casting where no harm will result.

H. W. BURY.